

# Gender-Affirming Surgery: A Visual Resource for Patients, Relatives, and Healthcare Providers

by  
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## **Abstract**

Gender dysphoria occurs when an individual's psychological identity as a male or female conflicts with their biological sexual characteristics, resulting in anxiety, depression, and distress. Transgender individuals often face harassment, discrimination, and stigmatization. Discrimination and transphobic experiences in clinical settings can erode trust in the healthcare system by the transgender community, and by extension, negatively affect the health of the transgender patient.

Gender-affirming surgeries are being performed with increasing frequency. In 2014, the Affordable Care Act banned discrimination based on gender identity, and Medicare coverage was extended to include transgender surgical treatment. The number of transgender individuals seeking gender-affirming surgery is expected to rise.

Gender-affirming bottom and facial surgeries are complex, difficult to conceptualize procedures and require the patient to make decisions about permanently changing two intimate parts of the body: the pelvic anatomy and face. Failure of the patient to understand resulting anatomical changes and the implications those changes have for post-operative function and upkeep can lead to low post-operative satisfaction and patient outcomes. Patient-doctor communication is crucial for effective decision making by the patient. It is also important to educate potential downstream healthcare providers who may be unfamiliar with these procedures and the new anatomy of post-surgical patients.

Existing visual resources on gender-affirming surgery are limited; they often lack clarity, are inconsistent, or are not designed for patient education. Videos and photographs may be graphic and impractical for teaching purposes. A full color, gender and racially sensitive patient education resource was created with input from professionals at the Johns Hopkins Center for Transgender Health. It includes nine male to female vaginoplasty images, six female to male phalloplasty images, and four donor site images. Several images employ an innovative color-coding system to describe tissue repositioning. A ten-image facial feminization surgery interactive module was designed to educate patients on realistic post-surgical outcomes of six procedures that modify facial structure. The images, rich in detail and aesthetically pleasing, will facilitate doctor-patient communication, aid patient decision-making, and improve health outcomes and trust in the healthcare system for the transgender community.

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# Introduction

## *Gender Dysphoria*

Gender dysphoria presents as a conflict between a person's physical or assigned gender and the gender with which they psychologically identify (Ainsworth and Spiegel 2010). Individuals may describe a discomfort with their body and the expectations presented to them by society, and report feeling significant distress, anxiety, or depression as a result.

By definition, a male to female (MTF) transgender woman was identified as male at birth, developed the physical characteristics of a male, but psychologically identifies with the female gender. In contrast, a female to male (FTM) transgender man was identified as female at birth, has physical characteristics of a female, but identifies psychologically with the male gender (Ainsworth and Spiegel 2010). In both cases, the individual is considered transgender regardless of whether she or he undergoes medical intervention or not. The term cisgender refers to an individual who psychologically identifies with the external physical characteristics of the gender they were assigned at birth.

## *Gender Dysphoria vs Stigmatization of Gender Nonconformity*

Gender dysphoria, though linked to lower feelings of mental well-being and self-acceptance, is distinct from the stigmatization of gender nonconformity, which can lead to significant discrimination, psychological distress and compromised mental health. The minority stress model describes chronic high levels of stress and anxiety experienced by members of stigmatized minority groups. These heightened stress levels are additive to the baseline levels of stress experienced by all people, and can be external, resulting from actual experiences of discrimination and rejection, or internal, resulting from perceived rejection, the expectation of being discriminated against, or hiding minority status for fear of being discriminated against (Bockting et al 2013).

Transgender individuals face high levels of harassment, discrimination, and sexual assault resulting from the stigmatization of gender nonconformity. In a study of 402 transgender individuals, 56% reported experiencing verbal harassment, 37% reported employment discrimination, and 19% reported physical violence (Bockting et al 2013). In a San Francisco, California study of 515 transgender individuals, 62% of transgender women and 55% of transgender men reported experiencing clinical depression (Bockting et al 2013). Though suicide ideation and attempted suicide are not significantly increased by or inherent to gender nonconformity itself or to being transgender, it is positively correlated

with depression. In a sample of 573 transgender individuals in San Francisco and Oakland California, 64% of participants who had experienced suicide ideation reported suicide attempts resulting from depression (Nemoto et al 2011). Half of the participants in the previously mentioned sample population reported being physically assaulted (Nemoto et al 2011).

Transgender individuals also face disparity in healthcare, which can result from discriminatory laws, transphobic experiences in health care settings, and a lack of access to gender sensitive health care. In a 2018 study, 84.4% of patients seeking gender-affirming surgery paid out of pocket in high volume centers. High volume refers to hospitals that performed more than 50 gender-affirming surgeries per year (Canner et al 2018). For many, lack of insurance coverage for gender-affirming surgery as well as lack of access to gender sensitive resources are barriers to obtaining safe, high quality health care. Social acceptance, integration, and validation of minority identity (gender nonconformity, in this case) can significantly reduce minority stress and improve psychological health for transgender individuals. Moreover, greater access to gender-sensitive health care and health resources can strengthen trust in the health care system and benefit the overall health equity and health outcomes of transgender individuals.

#### *Gender-Affirming Surgery*

Options to alleviate gender dysphoria include transitioning to the preferred gender both physically and socially. This transition can be achieved using hormones, adopting behavior, mannerisms, and clothing of their preferred gender, and undergoing gender-affirming surgery. Even minor surgical changes can significantly reduce gender dysphoric feelings and improve patients' self-esteem and function (Canner et al 2018).

There are currently three distinct categories of gender-affirming surgery: top, bottom, and facial surgery. Bottom surgeries are the most prevalent inpatient gender-affirming procedures. From 2006-2011, 83.9% of transgender patients seeking gender-affirming surgery pursued bottom surgery alone in an inpatient setting (Canner et al 2018). This project focuses primarily on bottom and facial surgeries.

Bottom surgery includes modification of the individual's urogenital anatomy with the goal of producing a functional neo-vagina or neo-phallus, and also encompasses the removal or modification of other primary sex organs, such as the testes, ovaries, and uterus.

Vaginoplasties and phalloplasties are complex, lengthy operative procedures which result in vastly different pelvic anatomy from a patient's pre-operative state, and both are particularly difficult to

conceptualize. Additionally, unlike many other surgical procedures, there are multiple acceptable methods and combinations of methods used by surgeons who perform these operations. This paper will focus on the techniques used by the Johns Hopkins Hospital (JHH).

The Johns Hopkins Center for Transgender Health (JHCTH), which opened in 2017, is a multidisciplinary team including professionals from departments such as plastic surgery, endocrinology, urology, laryngology and voice services, dermatology, and pediatric and adolescent medicine. The mission of the Center is

to reduce health care disparities and improve the overall health of the transgender community through world-class clinical care, medical education and research. Embracing diversity and inclusion, the Center for Transgender Health provides affirming, objective, person-centered care to improve health and enhance wellness; educates interdisciplinary health care professionals to provide culturally competent, evidence-based care; informs the public on transgender health issues; and advances medical knowledge by conducting biomedical research.

Several procedures available to transgender patients fall outside the scope of this thesis. Mastectomies and breast augmentations are typically the first operations a patient undergoes for FTM and MTF transitions respectively. Removing sexual organs, such as the testes and ovaries can aid in hormonal transitioning. Another surgical option for FTM patients is a metoidioplasty. This procedure modifies the tissue of the hormonally enlarged clitoris to give it a more penile shape, producing a penis of about 1.5 to 2 inches in length (Berlin 2016). None of these procedures are described in this project.

### *Vaginoplasty*

Multiple techniques have been used for vaginoplasty procedures in MTF transitions since they were first performed in 1931 (Selvaggi et al 2005). Sir Harold Gillies was one of the first surgeons to successfully perform male to female gender affirming surgery. Gillies and Dr. Ralph Millard were the first to describe the skin flap technique to produce a vaginal cavity, a technique that remained in use for several years (Bizec et al 2014). In 1956, Fogh-Anderson was the first to detail the creation of a neo-vagina from a full thickness skin graft using penile skin (Bizec et al 2014).

There are five broad categories of methods to create a neo-vagina: non-genital skin grafts, penile skin grafts, penile-scrotal skin grafts, non-genital skin flaps, and pedicled intestinal transplants (Selvaggi et al 2005). Today, the most common techniques used by surgeons are the penile skin inversion and



pedicled intestinal transplant techniques, with penile skin inversion considered the gold standard in MTF gender-affirming surgery. Penile skin inversion allows for sensation in the neo-vagina, adequate vaginal depth for sexual intercourse, sensitivity of the neo-clitoris, and an aesthetically acceptable external appearance of the labia (Bizec et al 2014). Additionally, the resulting neo-vagina is less likely to contract post-operatively, and there are fewer reported cases of vaginal prolapse. However, disadvantages include the need for permanent hair removal prior to surgery if a scrotal skin graft is used, the need for vaginal dilators after surgery, and potential limitations to the depth of the neo-vagina based on available penile and scrotal tissue.

Three common approaches to the procedure of penile skin grafts include using a single graft of inverted penile skin attached to an abdominal pedicle, a split penile skin flap to create a rectangular flap that can be lengthened by attaching a scrotal skin graft, and a pedicled penile skin flap using a vascularized urethral flap embedded into the penile skin to create mucosa (Bizec et al 2014). This thesis focuses on the vaginoplasty technique used at the Johns Hopkins Hospital, characterized by a pedicled inverted penile skin tube, a vascularized section of spatulated urethra sutured to the penile tube to form external mucosa of the vagina, and the addition of a scrotal skin graft to increase vaginal depth.

#### *Vaginoplasty Surgical Technique*

The transgender vaginoplasty encompasses a multi-step process that begins with penile disassembly: degloving the penis to form a skin tube, harvesting a scrotal tissue graft, and removal of most of the corpus cavernosum erectile tissue. Nerves and vessels running along the dorsal side of the penis are dissected free and left connected to the tissue of the glans penis, part of which will become the neo-clitoris. The cut ends of the corpus cavernosum that insert onto the ischium are sutured in place. The majority of the corpus spongiosum is removed. The glans is cut and shaped to resemble a clitoris, and the urethra is spatulated to form the external pink mucosa of the neo-vagina. This mucosa extends toward the new location of the glans tissue. The skin graft previously removed from the scrotum is sutured onto the end of the penile skin tube, and this elongated scrotal and penile skin tube is inverted and inserted into the space between the bladder/prostate, and the rectum. Stretching the skin of the groin creates a pouching affect that aids in the formation of the neo-labia majora.

#### *Phalloplasty*

A variety of approaches have been proposed for transgender phalloplasties since the early and mid 1900s when the procedure was first described. The first free flap phalloplasties for gender-affirming

surgery were performed in the 1970s and 80s. The tube-within-a-tube method using a radial free forearm flap proposed by Chang and Hwang is the basis of most phalloplasty techniques used today (Rashid and Tamimy 2013). The ideal phalloplasty produces an aesthetically pleasing, continent neo-phallus that allows for voiding while standing, with suitable sensation and rigidity for sexual function (Matti et al 1988). It is also preferable that the phalloplasty be performed in one procedure (Hage and De Graaf 1993). Many surgeons currently perform the creation of the phallus as a single procedure, with a scrotoplasty, vaginectomy, and testicular and penile implant insertion performed in later surgeries to ensure optimal results.

The phalloplasty is one of the most complex surgical procedures performed today, and complications include donor site scarring, donor site morbidity, infection, urethral stricture, urethral fistula, and hematoma. These complications can be as high as 80% in cases where a neo-urethra is created (Monstrey et al 2011). In a 1988 paper, the treatment of five FTM patients with urethral lengthening showed disappointing results. No patients were capable of using their neo-phallus for intercourse, and cases of fistulas, thrombosis, and partial or full loss of the flap were recorded for nearly all patients (Matti et al 1988). Though surgical advancement continues to reduce the incidence of complications in phalloplasties, risks remain. Often, compromises must be made based on the risk of complications and the patient's desired post-operative outcomes. For example, it may not be feasible to 1) create a new, lengthened urethra that allows voiding while standing, *and* 2) have a penile implant or stiffener that allows the neo-phallus to be used for sexual intercourse, *and* 3) use a less obvious donor site, such as the thigh.

The radial free forearm flap (RFFF) is considered the gold standard of phalloplasty donor sites by many surgeons today. In a 2008 clinical study of a cohort of 11 patients, no cases of flap loss or donor site morbidity were reported (Lumen et al 2008). However, other potential donor sites are occasionally explored, such as fibula flaps, latissimus dorsi free flaps, free scapular flaps, and groin flaps (Rashid and Tamimy 2013).

Recently, the anterolateral thigh flap has been more frequently used to create the neo-phallus, and this donor site is often requested by patients. Patients typically request the thigh donor site because they want a less prominent post-operative scar, but the surgeon may choose the thigh flap as the donor site based on other factors (Lumen et al 2008). These can include problems with the forearm donor site, such as scarring from other procedures or past injuries, or poor-quality tissue and nerves in the forearm. The surgeon may also opt to use the thigh donor site if the patient does not want urethral lengthening or the insertion of a penile prosthetic in the future. Though the anterolateral thigh flap is comparable to the

radial free forearm flap in terms of low morbidity, the thickness of the tissue and resulting phallus created from a thigh flap can pose a problem if the patient's goal is to have penetrative sexual intercourse post-operatively, especially if both a lengthened neo-urethra and a penile prosthetic are desired by the patient. In patients with a higher BMI and thick tissue in the thigh, the resulting phallus can be too thick to be inserted into a vagina. Additionally, sensitivity can be lower in a phallus created from an anterolateral thigh flap (Lumen et al 2008). The anterolateral thigh flap donor site contains one major cutaneous nerve as opposed to two nerves in the forearm.

### *Radial Free Forearm Flap Surgical Technique*

Prior to the first procedure, most patients seeking urethral lengthening must undergo permanent hair removal, by laser or electrolysis, to prepare the donor site, as excess forearm hair can lead to obstruction of the urethra. A vascularized flap of skin on the forearm is dissected. The ulnar side of the forearm is used to create the neo-urethra, which is extended proximally to provide sufficient length for the urethral anastomosis. The majority of the flap is devoted to the creation of the phallus. The phallus is created using a tube-within-a-tube method if urethral lengthening is requested. A thin tube of forearm tissue is rolled around a catheter to form the urethra, and the phallus portion of the flap is then wrapped around this urethral tube. Simultaneous to the flap preparation, the recipient vessels in the groin are dissected and prepared for anastomosis with the vessels from the flap (Monstrey et al 2011).

The creation of a glans shape is important to many patients, and is essential for an aesthetic phallus (Rashid and Tamimy 2013). This part of the phalloplasty typically involves rolling up a layer of de-epithelialized skin to form a ridge, and suturing it to form the corona. A skin graft is used to cover the resulting defect and form the coronal sulcus.

Once the forearm flap has been rolled into the shape of a phallus, microsurgery is performed to connect the nerves and vessels from the forearm skin to nerves and vasculature in the groin. The anastomoses performed at JHH are listed in Table 1; other variations are common.

<b>Forearm Flap</b>	<b>Groin</b>
Cephalic Vein	Saphenous Vein
Radial Artery	Epigender-Affirming Surgerytric Artery
Radial Vena Comitante	Epigender-Affirming Surgerytric Vein
Lateral Antebrachial Cutaneous Nerve	Dorsal Clitoral Nerve
Medial Antebrachial Cutaneous Nerve	Ilioinguinal Nerve
Branch of the Medial Antebrachial Cutaneous Nerve	Genitofemoral Nerve

*Table 1: The nerve and vessel anastomoses performed at the Johns Hopkins Hospital during a radial free forearm flap (RFFF) phalloplasty.*

The vagina and clitoris are left intact during this procedure, and the proximal end of the neo-urethra is exposed in the tissue lateral to the vagina. Post-operatively, the patient must dilate the neo-urethra with a catheter daily and continue to urinate while seated during the post-operative healing period. In a new technique, Integra®, a dermal regeneration material, may be used to temporarily cover the defect on the forearm instead of using an immediate skin graft.

During the second stage procedure, a vaginectomy is performed. This consists of the removal of the mucosal lining of the vaginal cavity and a pelvic floor reconstruction (Monstrey et al 2011). The proximal end of the neo-urethra is connected to the native urethra to allow for voiding while standing. A scrotum is constructed using two transposition flaps of the labia majora (Monstrey et al 2011). The insertion of a stiffener or penile prosthesis is performed as a potential third surgery.

#### *Facial Feminization Surgery*

Facial plastic surgeries modify the secondary sexual characteristics causing a face to appear more masculine or feminine. These reductive procedures are more frequently performed during MTF transitions, and are referred to as facial feminization surgery (FFS). FFS removes and contours parts of the bone structure that make the face appear more masculine.

Transgender women may experience considerable difficulty and distress regarding incongruences between their physical appearance and the assumptions and accepted norms of society. In many cases, adopting the behavior and clothing of a woman and undergoing bottom surgery is not sufficient to ensure they are perceived as female by the general public. FFS surgically alters masculine bone structure of the face that cannot be changed using other methods, such as hormones. Areas of the facial structure, such as the nose, forehead and brow, chin, and the anterior prominence of the thyroid cartilage (Adam's apple) commonly differ in faces that appear masculine or feminine. FFS includes surgical procedures such as forehead contouring, scalp advancement, brow lifts, chin and jaw contouring, rhinoplasties, chondrolaryngoplasties (tracheal shaves), lip lifts, cheek augmentation, and facelifts (Berlin 2016). Non-surgical procedures, such as injective fillers and Botox treatments, are also options for facial feminization, but fall outside the scope of this thesis.

#### *Decision Making for Elective Surgery*

FFS poses a unique communication challenge for patient and surgeon. These elective surgeries are rarely paid for by insurance, can be very costly, and therefore each procedure must be prioritized

by the patient and their surgeon to ensure optimal results while limiting cost. It is often difficult for the surgeon to convey what surgical changes will give the patient the most objectively effective results during this ranking process. For example, a patient may be unsatisfied with her nose and want it changed with a rhinoplasty, when in reality, a prominent brow bone contributes more to her masculine appearance, and forehead contouring would be a more effective solution.

#### *Race and Ethnicity in FFS*

Race, by definition, includes people of similar heritage who may or may not have genetic commonalities. Though there are wide ranges of phenotypic variation among individuals of each race, many share similar overarching physical characteristics (Sturm-O'Brien et al 2010). Race is often defined externally. An individual's race is often determined by the perceptions of those around him or her, and may or may not align with the individual's personal views or standards of beauty. Race is difficult to quantify from a clinical standpoint, and poses a challenge regarding FFS and other facial cosmetic surgery. First, because race has almost no measurable scientific or genetic bearing that can be applied to a wide range of clinical situations, and second, because it is very subjective.

Black, Hispanic, and Asian patients increasingly seek cosmetic surgery, and trends are shifting from using the same approach to faces of all races, to taking into account the subtleties particular to the patient's race and cultural standards. Populations of racial minorities continue to grow in both size and economic influence in the United States. Asian, Hispanic, and Black patient populations seeking cosmetic surgery increased by 200%, 323%, and 340% respectively from 1999 to 2001 (Sturm O'Brien et al 2010).

Ethnicity, by definition, is a subjective term describing an individual's cultural background. Ethnicity is self-assigned and based on the group with which an individual identifies and feels a part of. Two individuals who appear to be of the same race may come from different ethnic backgrounds, and therefore hold vastly different cultural identities and standards of beauty (Sturm O'Brien et al 2010).

It is important for the plastic surgeon to perform operations focusing on each patient's distinct features, while paying attention to general trends of race and ethnicity during surgical planning (Sturm O'Brien et al 2010). General trends based on racial phenotypes can also be a helpful tool for educating patients on what to expect from an FFS procedure.

#### *Need for Visual Communication Regarding Gender-Affirming surgery*

Surgical procedures patients undergo while transitioning to a different gender are some of the

most complex procedures that can be performed using modern medicine. In transgender vaginoplasties and phalloplasties, the pelvic anatomy is completely changed with the intent of mimicking both the form and function of a specialized sexual organ while continuing to perform the everyday bodily functions of urination and defecation. During a radial forearm free flap phalloplasty, at least 2 microsurgical nerve anastomoses, 3 vessel anastomoses, and a urethral anastomosis that redirects the patient's urinary flow are formed. During a vaginoplasty, a male sexual organ must be deconstructed and repurposed without undue damage to the delicate nerves and vessels of the pelvic region. During FFS, the part of the patient most visible to the world, the face, must be subtly changed in ways that are difficult to quantify, but are instantly recognizable by all others who come in contact with the patient.

Vaginoplasties, and phalloplasties have higher risks of complication than other procedures, with phalloplasties being the riskiest and most likely to fail entirely. Many patients considering gender-affirming surgery may not understand the necessary, lifelong commitment to post-surgical maintenance or the differences that their newly created anatomy will have from their previous anatomy or that of a cisgender individual. There is great need for counsel and education in order to ensure patients understand the complexity, potential risks and complications, as well as surgical outcomes and required maintenance following gender-affirming surgery. A lack of understanding or failure to comply with post-surgical directions or upkeep can result in the surgically altered anatomy being rendered completely useless or damaged beyond repair. Overly high expectations, including overpromising, can lead to low post-operative satisfaction.

Understanding of these procedures is low in the general public, and, importantly, is also low in many health providers providing downstream care for individuals who have undergone transgender surgery. For example, in an emergency situation, a healthcare provider with little understanding of post-operative anatomy may hesitate before the installation of a catheter, especially in the case of a post-operative phalloplasty patient who did not receive urethral lengthening, and has a native urethral opening at the base of the neo-phallus, rather than the distal end.

Currently, there are very few engaging, accurate visual resources designed for transgender patients, with most resources limited to copious text and pre- and post-op photographs, rather than educational illustrations or interactive media. Existing online illustrations are often small, low resolution, or difficult to understand. Additionally, many sites aimed at educating the transgender patient population reuse a limited pool of illustrations, many of which are not originally intended for this project's target audience, or an audience that does not have a background in medicine (Figure 1). For example, the website

called phallo.net, an informational site aimed at FTM individuals, uses illustrations from microsurgeon.org, a website designed for surgical residents. The images taken from microsurgeon.org are not specifically designed to teach about radial forearm free flap phalloplasties, and do not contain information particular to that procedure. Primary literature and studies on the subject are inaccessible to much of the general public, 1) because they may require a paid journal subscription to view, and 2), because they contain terminology and images too detailed or too graphic for viewers who do not have a medical background. Older primary literature may describe techniques that are no longer in use, and this outdated information may be disseminated by patients unfamiliar with the current state of gender-affirming surgery. Furthermore, it is common for social media resources regarding transgender surgery to include abundant commentary, unproductive input, and misinformation. As a result, patients considering and seeking information on transgender procedures often encounter disparaging comments or well-meaning but ineffective advice from others.

**Radial Forearm Flap Phalloplasty Surgery**

Radial forearm flap is the most common type of FTM phalloplasty. The donor site is thin and supple allowing the flap to be easily tubed and shaped into a penis, and the relatively hairless skin provides erogenous sensation and allows urethral reconstruction in a single stage.

The radial forearm donor site can be closed using a split thickness unmeshed skin graft harvested from the thigh or a full thickness graft from the buttocks.

A Foley catheter is left in place for at least 2 weeks to reduce the risk of stricture and fistula formation while the neo-urethra is healing.

Source: [microsurgeon.org](http://microsurgeon.org)

(A) the outline of the radial forearm phalloplasty flap on the arm. The lateral and medial antebrachial cutaneous nerves can be coapted to the ilioinguinal and dorsal penile nerves. The radial artery of the flap can be anastomosed to either the profunda femoris, lateral circumflex femoral, circumflex iliac, or the inferior epigastric artery. The venae comitantes and the cephalic vein of the flap can be anastomosed to branches of the greater saphenous vein. (B) Illustration of the flap following inset, anastomosis, and coaptation. Source: *Semin Plast Surg.* Aug 2011; 25(3): 196-205.

Aesthetics can be refined with [glansplasty](#): the creation of a corona using a local flap and full thickness skin graft. Tattooing of the corona to match the color of the areola can be done 3 months before sensation returns.

Erectile function can be achieved using a [penile prosthesis](#) inserted at a second procedure 10 to 12 months later after tactile sensation has been restored.

**Ready to speak with a surgeon?**  
Submit the form below and a surgeon or surgeon's assistant will reply.  
\*Required Field

First Name:

Email:

Procedure(s) of Interest:

- ☐ Radial Forearm Phalloplasty
- ☐ ALT Phalloplasty
- ☐ MLD Phalloplasty
- ☐ Abdominal Phalloplasty
- ☐ Urethral Extension
- ☐ Vaginectomy
- ☐ Scrotoplasty & Testicular Implants

Questions or Comments:

**REQUEST INFO**

**FTM Surgery**  
5,561 likes

Be the first of your friends to like this

ftmphalloplasty on Tumblr

Will you, or did you, have Metoidioplasty surgery before your Phalloplasty?

Figure 1. A screenshot from phallo.net, and informational website aimed at FTM transgender individuals. Note the inconsistent orientation of the forearm, inconsistent media use, and most importantly, the first image depicts an entirely different procedure. Text not intended to be read.

Gender-affirming surgeries are currently being performed with greater frequency than any other period in history, and are becoming more affordable and accessible to transgender individuals. From 2012 to 2014, there was a threefold increase of patients seeking gender-affirming surgery who were covered by Medicare or Medicaid. In 2014 The Affordable Care Act banned discrimination on the basis of gender identity. That same year, the US Department of Health and Human Services lifted a prior exclusion of transsexual surgical treatment for Medicare coverage. It is anticipated that the number of patients seeking gender-affirming surgery will rise in the future. The purpose of this thesis is to develop a series of clear, accurate illustrations to educate transgender individuals considering or scheduled to undergo gender-affirming surgery and their loved ones. It is designed to improve the communication between patient and surgeon in making important decisions for this life changing surgery. This resource will also benefit clinicians who may provide care to patients who have had gender-affirming surgery. This thesis will also promote trust in healthcare systems through clear, accurate, aesthetic and gender sensitive representation in transgender patient education resources. It will also provide recognition and validation of a minority subset of patients, those seeking gender-affirming surgery.



## **Materials and Methods**

### *Background Research and Planning*

The initial stage of this project required extensive background research and preparation to become familiar with transgender procedures and existing resources depicting these operations. Devin O'Brien-Coon, MD, Medical Director of the Johns Hopkins Center for Transgender Health (JHCTH) and Wilmina Lanford, MD, Johns Hopkins Hospital Department of Plastic and Reconstructive Surgery Fellow and Assistant Resident, provided content expertise. Early discourse created a framework for the project by determining the target audience, the most effective means of reaching the target audience, and subject matter covered in the scope of the project. Discussions of surgical techniques before viewing the procedures in the operating room (OR) ensured that time in the OR was spent efficiently. A flowchart detailing the topics to be covered was designed (Figures 2-5). The flowchart served as a combined site map and list of required art assets, and was later revised based on clearer understanding of the needs of the target audience and the most effective ways to present the information.

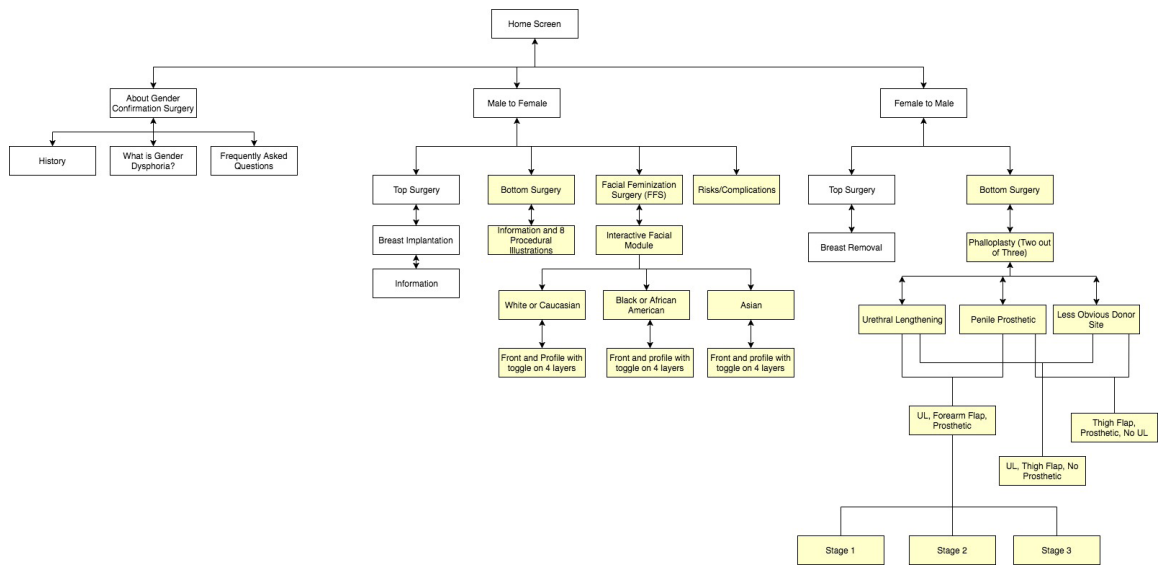


Figure 2. The first iteration of the flowchart/sitemap used throughout this project. Legible text in subsequent images.

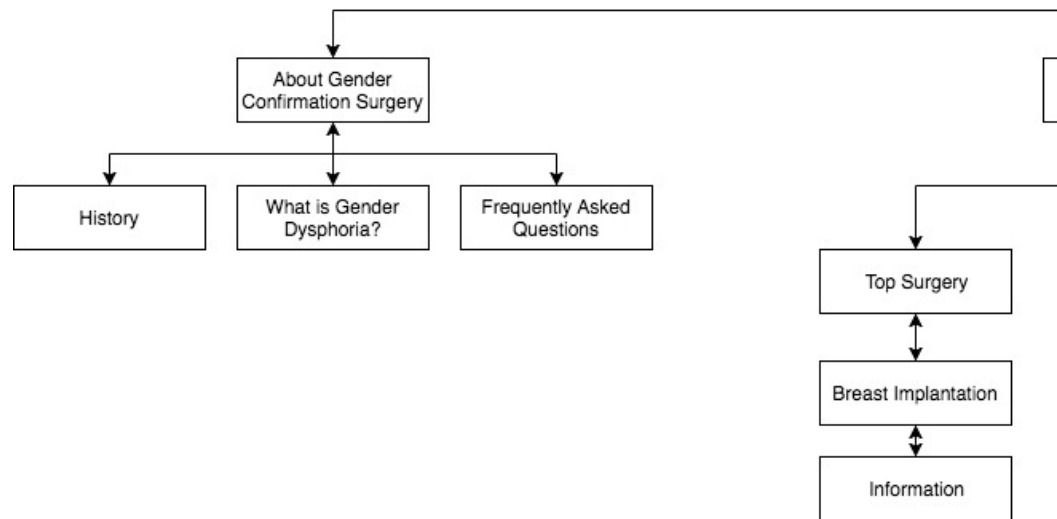


Figure 3. The left third of the first iteration of the flowchart. The image has been enlarged for legibility

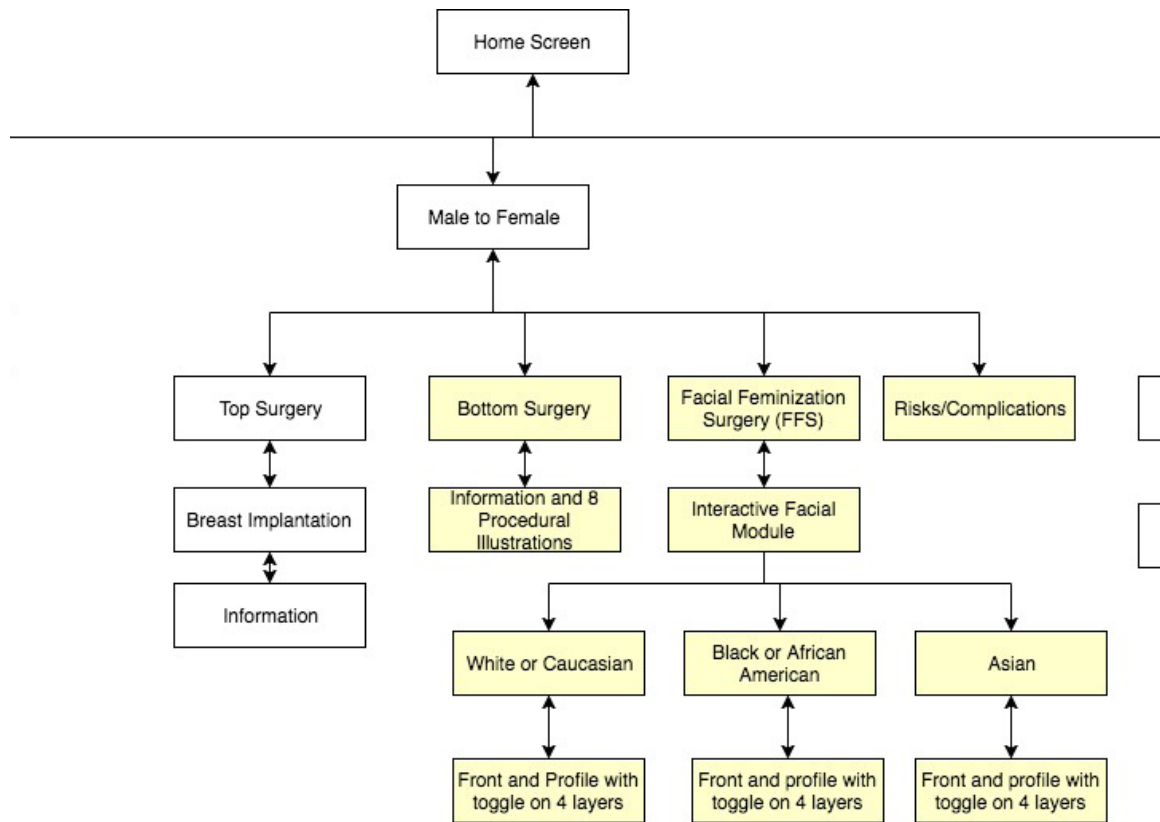


Figure 4. The middle of the first iteration of the flowchart. The image has been enlarged for legibility.

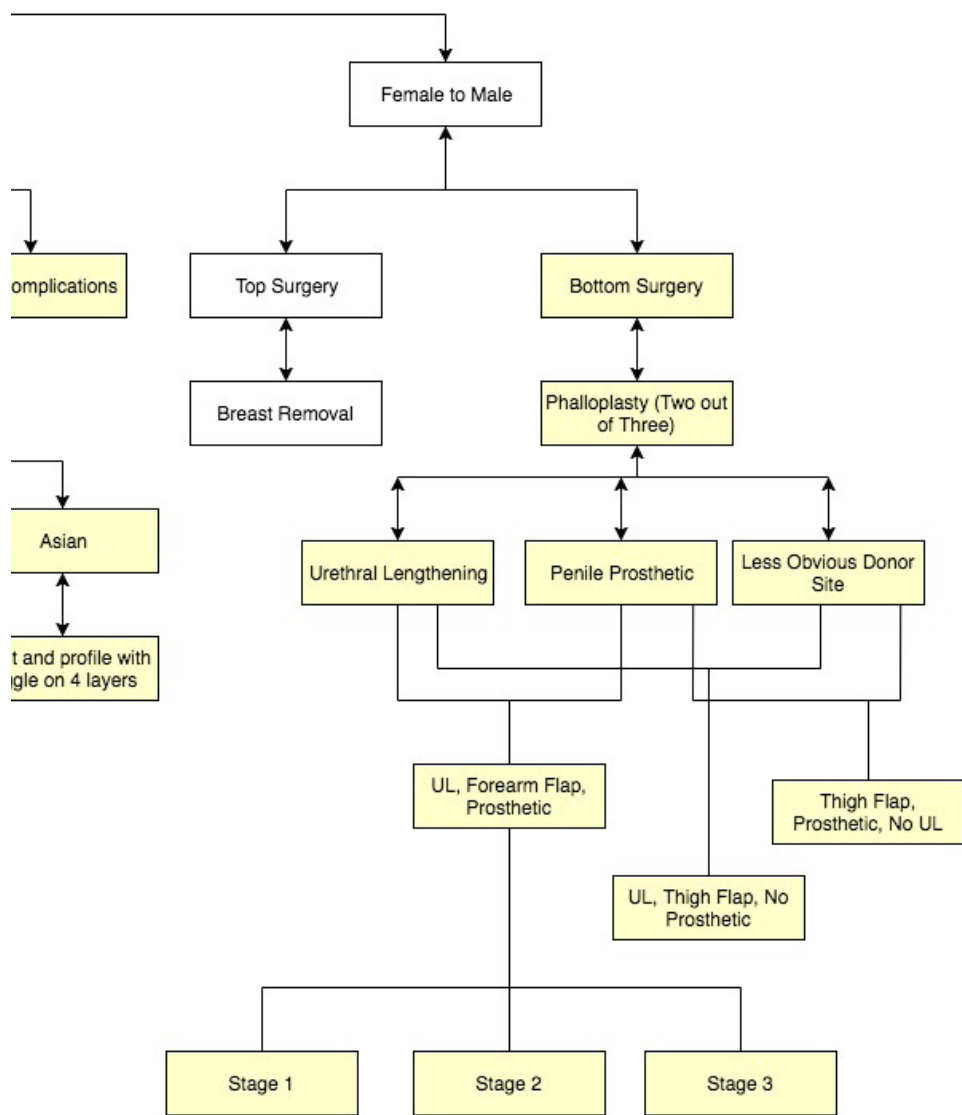


Figure 5. The right side of the first iteration of the flowchart. The image has been enlarged for legibility.

An extra step was added to the procedural vaginoplasty series for clarification (Figures 6-8). In the first version, viewers would have to make too large of a conceptual jump between steps. The part of the flowchart devoted to FFS was expanded to include six different facial features. The phalloplasty series was streamlined and the subject matter of the illustrations was changed to focus more on RFFF phalloplasties, the most frequent phalloplasty technique performed at the Johns Hopkins Hospital.

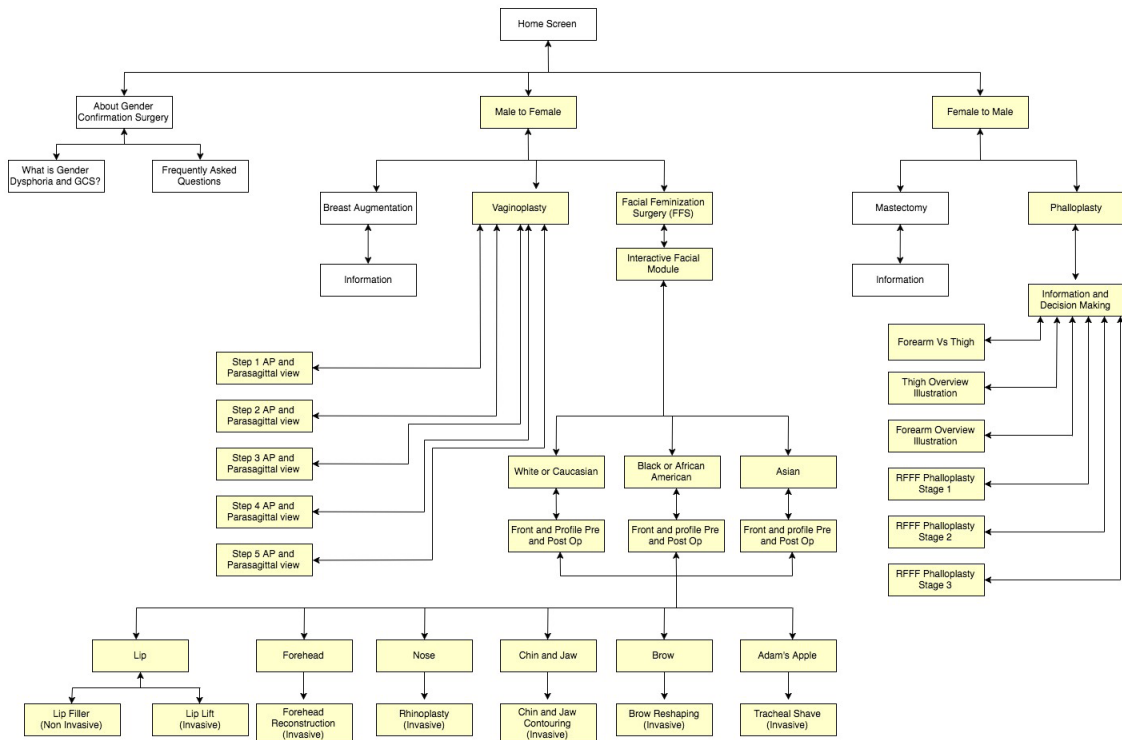


Figure 6. The final version of the flowchart/sitemap. Yellow indicates components completed in the scope of this thesis. Enlarged and legible images following.

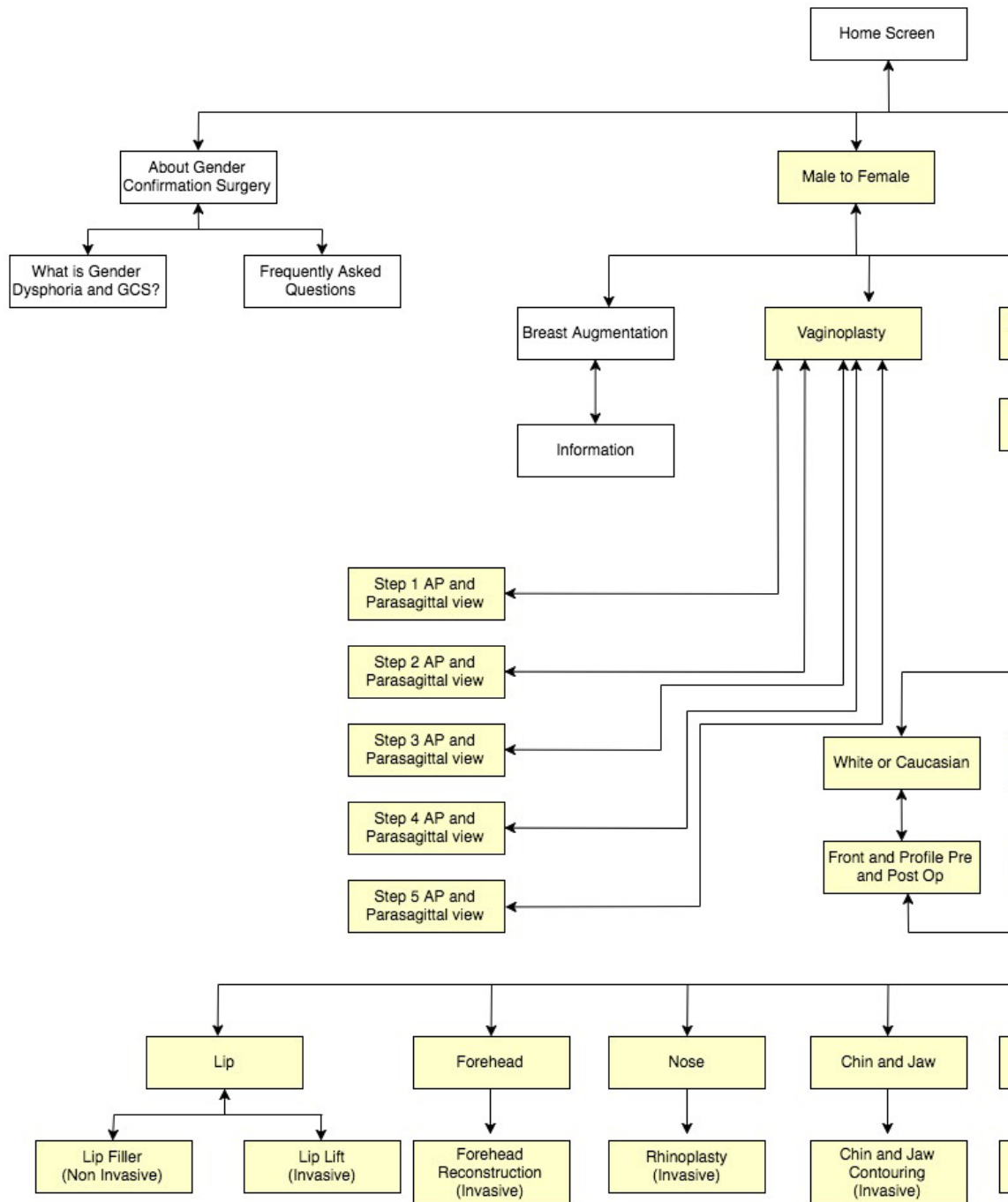


Figure 7. The left half of the second iteration of the flowchart. The image has been enlarged for legibility.

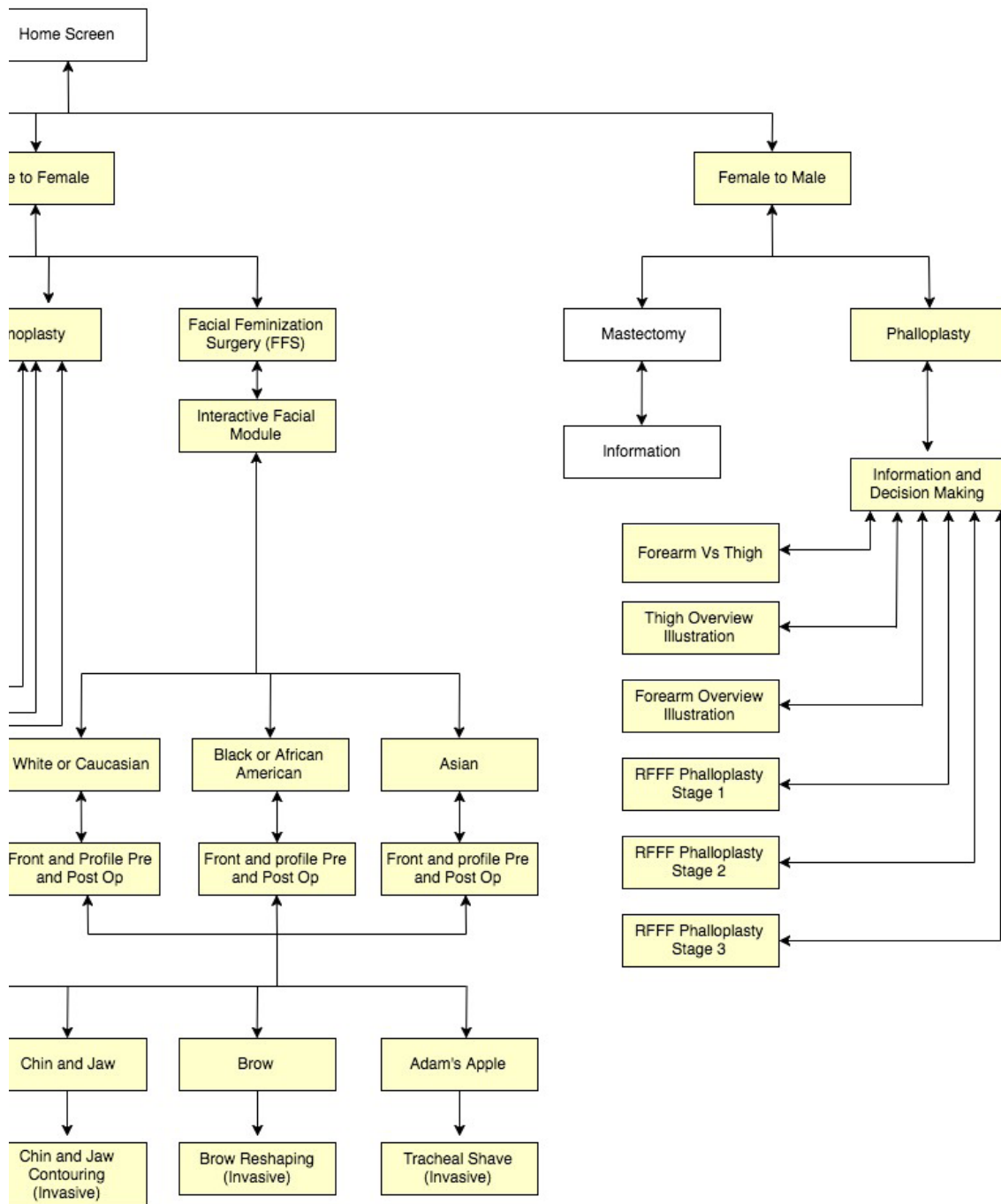


Figure 8. The right half of the second iteration of the flowchart used throughout this project. The image has been enlarged for legibility.

A review of the available academic literature regarding gender-affirming surgery was completed, providing background on the history of the field and procedures, current techniques and advancements, and widely used terminology. A web search helped determine what resources are currently available for patient support and education, and how many of those resources also include illustrations, animations, and interactivity. Terms used for the web search included: “gender reassignment surgery”, “transgender surgery”, “gender-affirming surgery”, “phalloplasty”, “vaginoplasty”, “facial feminization surgery”, “metoidioplasty”, and “transgender transitioning”.

### *Surgery Viewing and Sketching*

Procedures of MTF vaginoplasty, FTM phalloplasty, and MTF FFS performed by Dr. Devin O’Brien-Coon were observed throughout the course of this thesis. Observational pencil sketches were created in the OR and used to deepen knowledge of techniques used at the Johns Hopkins Hospital (Figure 9). OR observation was beneficial to understand steps of the procedures, and see the tissue in a non-simplified manner. For the vaginoplasty series, this observation provided firsthand knowledge of the spaces between cavities and openings, the locations of sutures, and the directions that tissue was pulled or moved. For the phalloplasty series, OR observation and sketching revealed the thickness and texture of tissues and relative size of structures. During both procedures, suturing was noted, as it was used to shape structures, such as the glans. Following observation of the surgical procedures, decisions were made regarding the appropriate complexity of the illustrations, to make them appealing to the viewer, while providing realistic expectations for surgical outcomes.



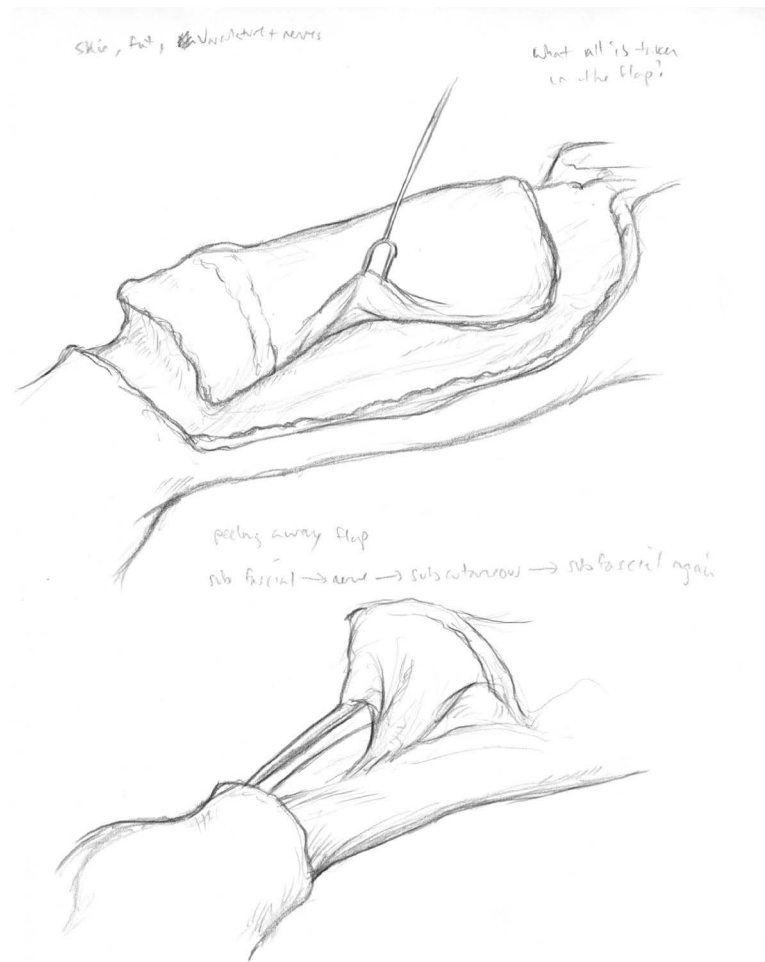


Figure 9. Pencil sketches and handwritten notes made in the OR while observing the flap dissection during a FTM RFFF phalloplasty.

### *Informal Patient Interviews*

In the initial stages of this project, patients in the JHCTH were interviewed for qualitative information regarding how they learned about gender-affirming surgery, what they understood before meeting with a medical professional, how comfortable they felt using medical terminology, and what resources they found most helpful. Information gained from these interviews was informal and anonymous. Examples of the questions asked in these conversations included:

- What tools did you use most frequently while learning about gender-affirming surgery? Websites? Social media? Friends? Other?
- How well do you understand medical terms related to these procedures? Please explain.
- How well informed did you feel about the risks and potential complications of Gender-affirming surgery procedures before you consulted with a medical professional?
- How did learning about the risks and complications affect your decision making? Please explain.
- How many surgeons did you consult with before you made your decision?

Though answers to these questions were varied, they provided valuable detailed information that helped in designing the final images. Patients commonly gathered information from the internet, were highly invested in seeking out as much information as possible, and often relied on referrals from friends and others in the transgender community. It was also common for patients to state that though they understood much of medical terminology when it was presented, they may not choose to use it themselves conversationally. It was common for a patient to consult with multiple medical professionals before undergoing surgery.

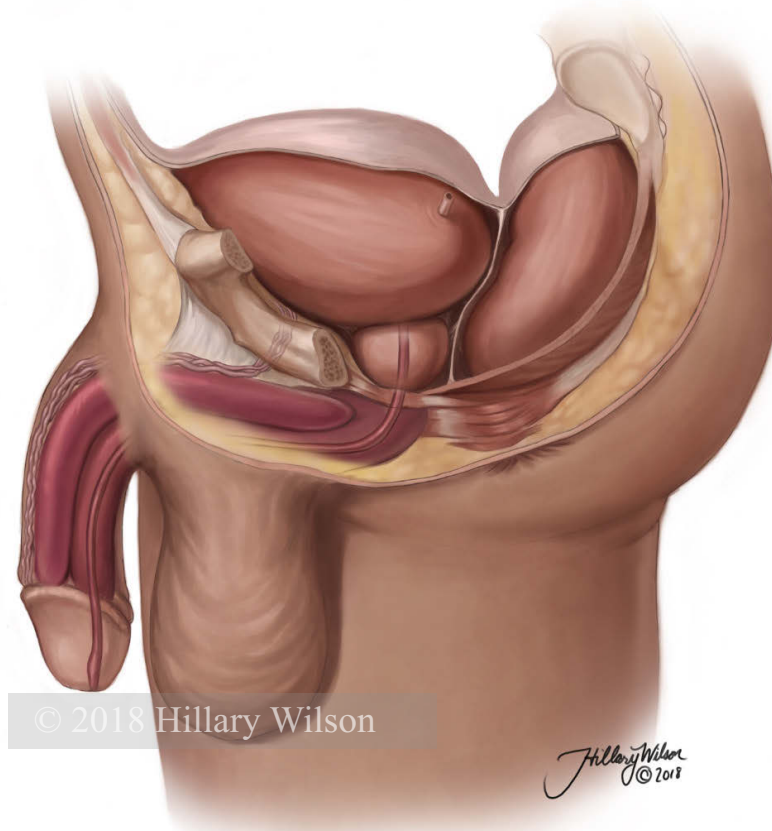
#### *Illustration Process*

During the creation of the illustrations in this project, planning was necessary to determine how many images would have sufficiently similar subject matter that base artwork could be created and modified to use time efficiently, establish consistency throughout artwork, and keep complex subject matter clear. It was determined that only areas of each illustration that were meant to be focused on by the viewer would be changed during sequential steps.

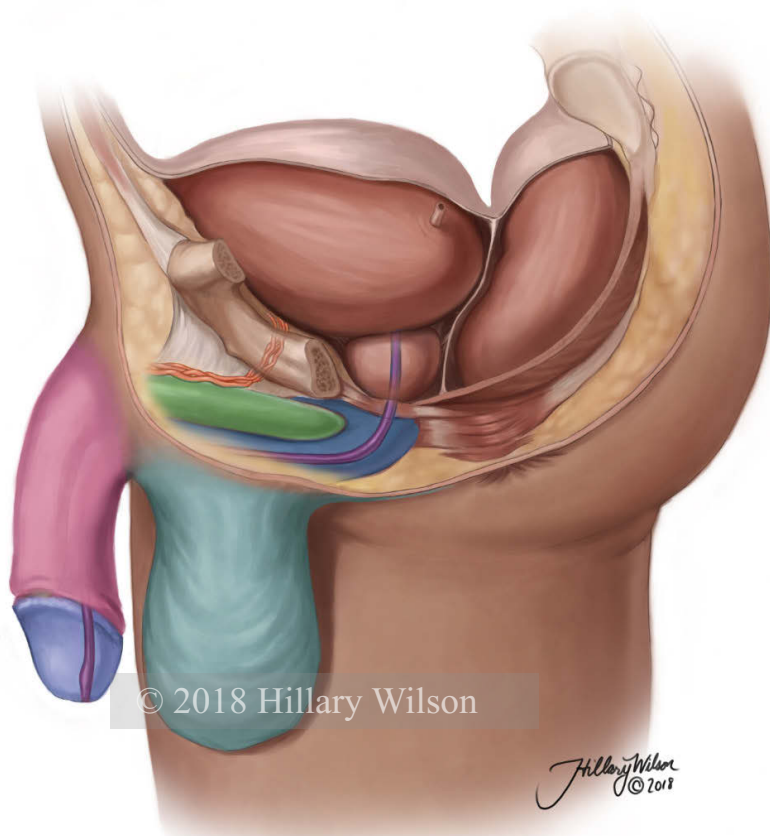
Adobe Photoshop was the primary tool used for the creation of art assets because it allowed for an artistic style that could make use of subtle lighting and rendering in order to distinguish between structures. A technique that mimicked opaque media such as oil paint was used for rendering. Major mid tones, shadows, and highlights were first blocked in to establish color and light direction, and the image was later cleaned up and refined with an airbrush tool. Separate views and insets were first created in individual files, and later combined to create a full composition. For example, the parasagittal and perineal views for the MTF vaginoplasty illustrations were each created separately as different files, and then the layers were brought into a new PSD file, placed in their own groups, and then arranged, color balanced, and refined.

### *Vaginoplasty Series*

In the series of the MTF vaginoplasty procedural illustrations, both the perineal and parasagittal views for each illustration relied on base artwork that was revised to create multiple illustrations efficiently. The artwork was first created using a simple color palette so that attention could be paid to lighting and the overall form of structures described (Figure 10). Once the artwork had been sufficiently developed, areas that required color-coding were copied as single, merged layers, placed in a separate group, and the hue, saturation, and curves were adjusted for each individual color (Figure 11). This allowed for the underlying artwork to remain unchanged, and each color could continue to be reworked and adjusted individually for clarity. In general, each of the illustrations had two groups, one for each view, with each group containing two layers devoted to the base artwork, and a separate layer devoted to each instructional color. There were nine final images in the vaginoplasty series



*Figure 10. The base artwork created for the MTF vaginoplasty illustrations before introduction of color-coding.*



*Figure 11. The base artwork created for the MTF vaginoplasty illustrations after the introduction of color-coding.*

### *Accessibility*

The color-coded images were run through a color blindness simulator at [color-blindness.com](http://color-blindness.com) that applies filters based on different types of color blindness, to determine if color-coding schema would be accessible for persons with color blindness. The application of multiple filters rendered the color-coding unhelpful in certain types of color blindness (Figures 12 and 13). To solve this limitation in accessibility, a colorblind friendly version that used a different color scheme was explored (Figure 14).

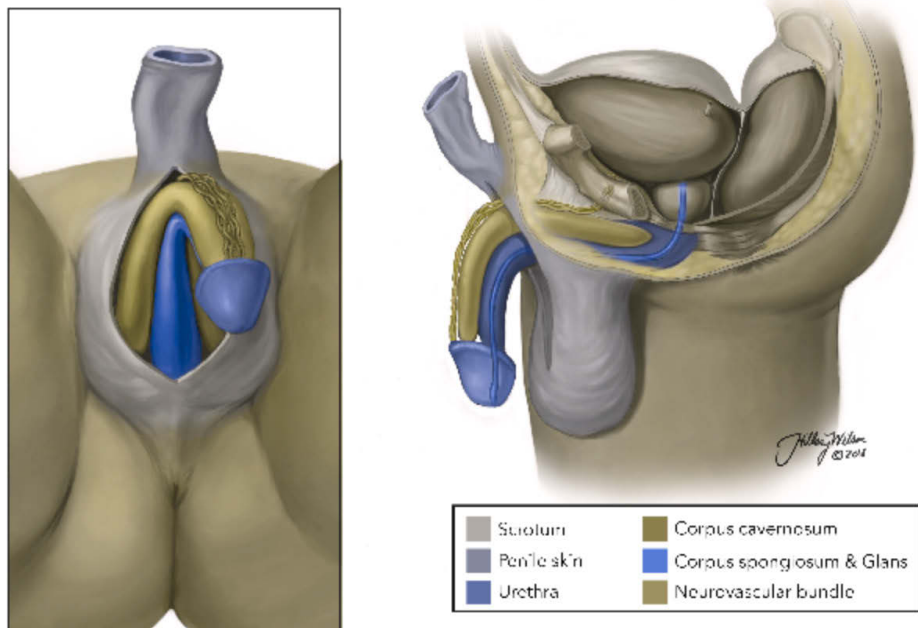


Figure 12. The base artwork with filter to simulate red blind protanopia. Text not intended to be read.

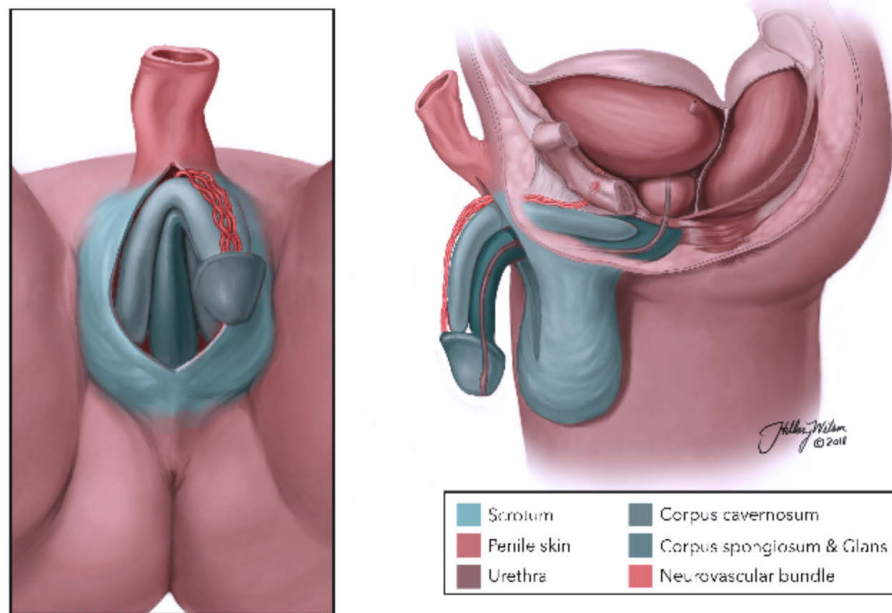
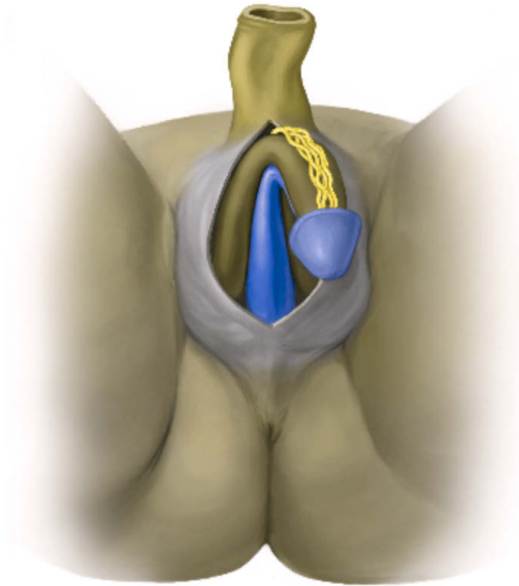


Figure 13. The base artwork with a filter to simulate blue blind tritanopia. Text not intended to be read.



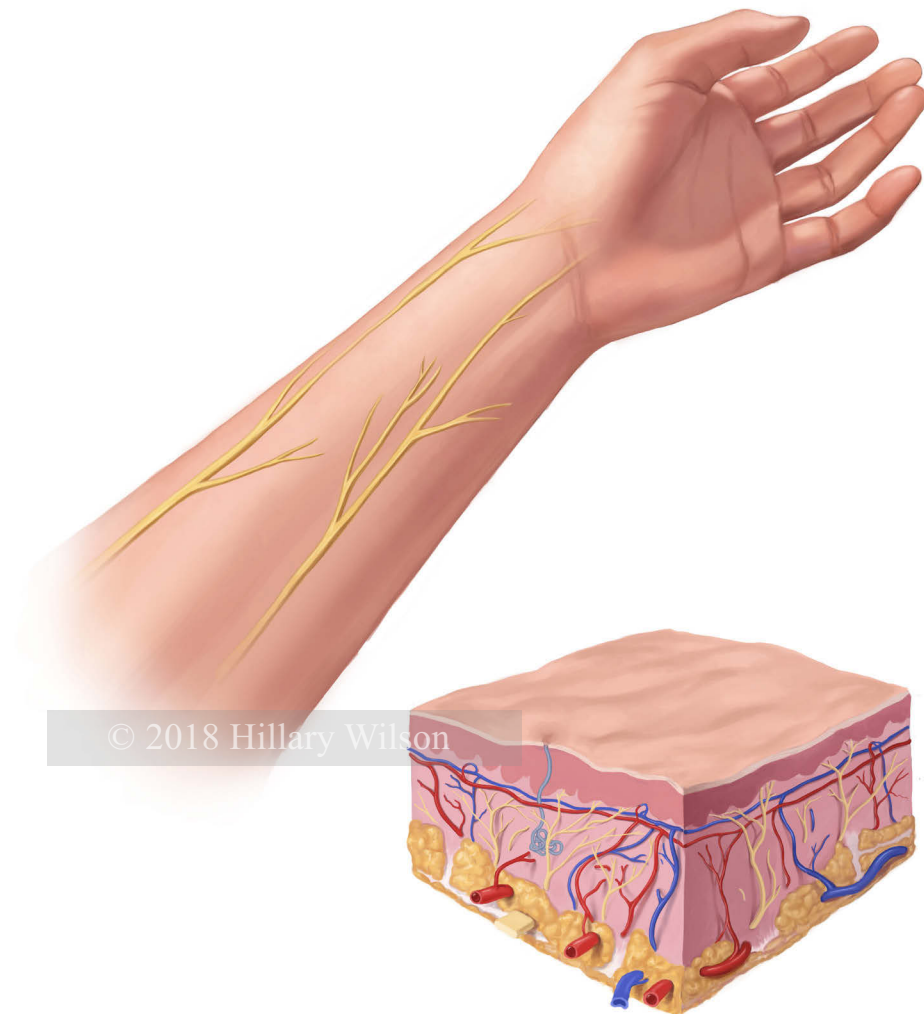
*Figure 14. The modified color scheme when a red blind protanopia filter had been applied. Note the modified brightness of the neurovascular bundle allowing its yellow to be distinguished from the yellow of the penile skin tube. The corpus cavernosum was lessened in brightness. The tissue of the scrotum and penis can also be distinguished.*

### *Phalloplasty Series*

The main artwork and insets of the FTM Phalloplasty series also relied on modifiable base artwork. The artwork for the two main views was created first the modified to create the three post-operative stages. A combination of photo reference and observation was used to ensure accuracy. When photo reference of post-operative patient anatomy was not available or sufficient, references of both male and female anatomy were combined. Male anatomy was used for accurate proportion of the neo-phallus, and female anatomy was referenced for the postoperative imagery of stage one, where the vagina was left largely unchanged. Each view and its respective layers were developed in a separate group in the Adobe Photoshop application, and once the basic form had been established, the layers were brightened and color balanced as needed to ensure that separate structures could be clearly identified and that views remained consistent. The art assets were then arranged, and labels were added in Adobe Illustrator to create a final layout.

### *Donor Site Series*

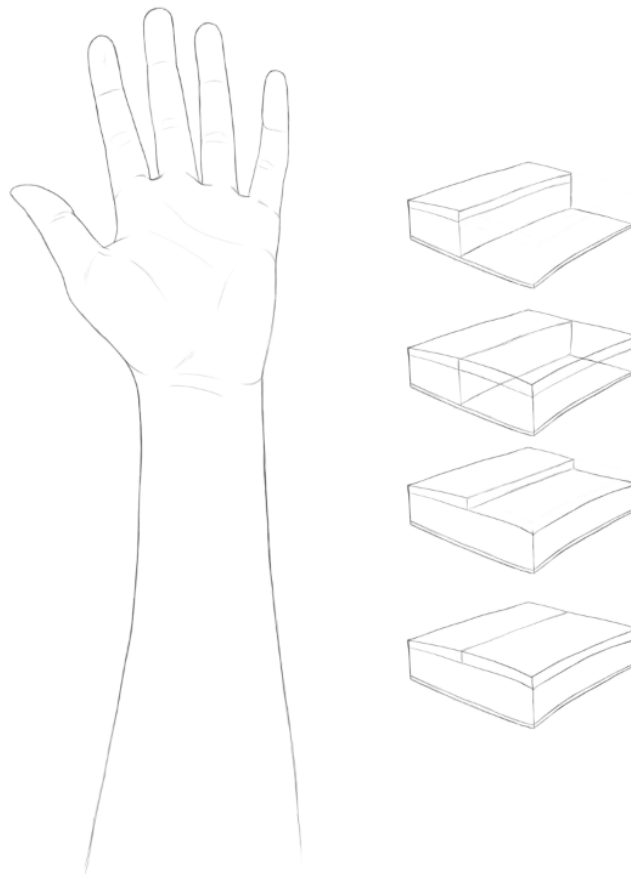
Because it is common for patients to request the thigh donor site to limit visible scarring, it was important to show a comparison between the thickness of the tissue, the cutaneous innervation, and the benefits and drawbacks for creating a phallus from the forearm and the thigh. The individual images for the forearm and thigh donor site comparison illustration were first created in separate files, then combined into a final file (Figure 15). A set of base artwork for the skin sections and the diagrammatic flaps was created first, then modified for the forearm and the thigh. Each was simplified and stylized for clarity. The forearm skin section was depicted as considerably thinner than the thigh skin section, and a greater number of small nerve branches were added to emphasize the higher level of innervation. The comparative flap roll sections were treated in a similar manner, though nerves and vessels were omitted for clarity. A simple color coding scheme separated the forearm series (green numbers and text) from the thigh series (blue numbers and text). Base artwork for both the flap roll sections, as well as the skin sections was reused for the additional, single-page Overview Fact Sheets for the forearm and thigh donor sites. These one page sheets were developed to provide more detail regarding the benefits and drawbacks for each donor site.



*Figure 15. Examples of base art assets created separately before being reused in the Donor Site Series.*



The Dermal Regeneration Template (DRT) fact sheet made use of previously created base artwork with the addition of five new art assets (Figure 16). Existing resources depicting the use of DRTs focused on improving wounds resulting from trauma and reconstructive surgery. DRTs are commonly used in burn healing. The commercial website for Integra®, the brand of DRT used at the Johns Hopkins



*Figure 16. Art assets created for use in the Dermal Regeneration Template Fact Sheet.*

Hospital, contained a series of seven images explaining how Integra® works. The content was compressed into four steps and adapted into a simplified illustration describing the process in generic terms. The fact sheet presents information regarding FTM forearm donor site scarring, rather than general wound healing.

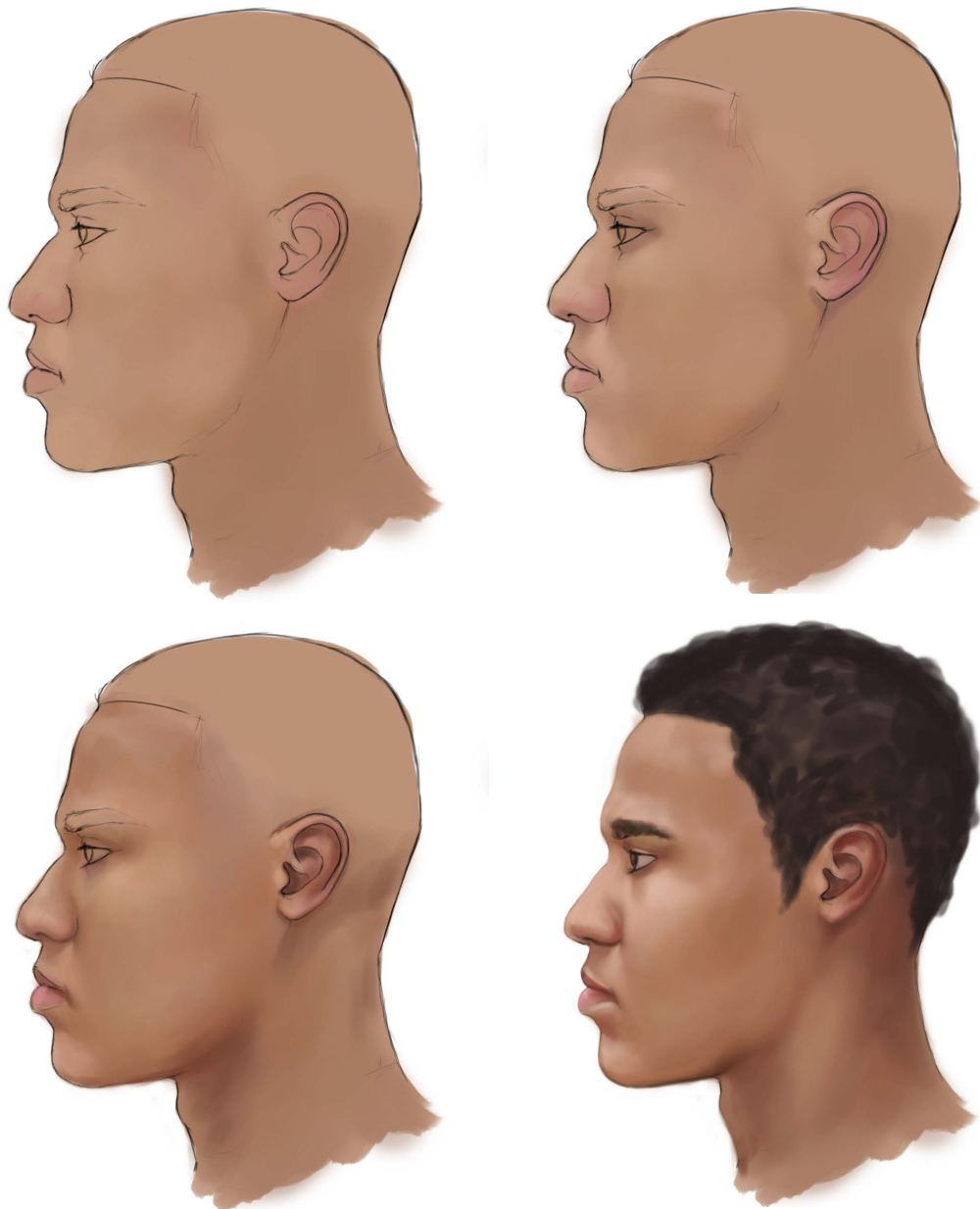
### *Facial Feminization Surgery Interactive Module*

The FFS illustrations required extensive research and review of facial features to gain a sufficient understanding of 1) what frequently differs in masculine versus feminine appearing faces, and 2) what frequently differs in faces that are perceived as Black/African American, White/Caucasian, and Asian. The challenge of individual facial variation was considered. The size and shape of features in one face of a particular racial phenotype could differ in other faces of the same racial phenotype. It was also important that the patient faces depicted in these images be “average” and not resemble a particular individual. To achieve that goal, a variety of reference photographs were viewed and combined. Accurate rendering of light and shadow was important for conveying bone structure, and base imagery was revised as needed to convey features in the most accurate manner (Figure 17 and 18). For each example patient, the masculine, pre-operative face was created first, copied, and then modified to make it appear more feminine, with feasible outcomes for FFS (Figure 19). Special attention was paid to discrete areas of the face such as the forehead, the brow bone, the nose, the lips the anterior prominence of the thyroid cartilage, the chin, and the jawline. Seven areas of the face, and the pre- (masculine) and post-operative (feminine) qualities of each feature were described (Table 2)

<b>Area of Face</b>	<b>Masculine</b>	<b>Feminine</b>
Forehead	Flat and Broad. Prominent highlights	Rounded. Gradual shading
Brow Bone	Protrudes outward slightly, giving eyes more hooded appearance. Prominent highlight applied to location of frontal sinus between the eyebrows and superior to nose.	Less prominent, more rounded. Lateral edges of eyebrows higher. No prominent highlight applied to the frontal sinus.
Nose	Nasolabial angle approximately 90 degrees. Tip more bulbous.	Nasolabial angle approximately 120 degrees. Tip more pointed
Thyroid Cartilage	Slight protrusion on the anterior part of the thyroid cartilage.. Strong highlight on “Adam’s apple”.	Less prominent. No strong highlights
Chin	Broad and square. Protrudes outward further	Rounded. Smaller. More pointed tip.
Jawline	Angular. More obvious plane changes.	Rounded. Gradual plane changes
Lips	Straighter upper lip.	Slight curvature to upper lip.

*Table 2: The areas of the face focused on in the FFS images, and common differences in masculine vs feminine appearing faces.*

An interactive FFS module was planned and its interface and functionality was designed but not implemented. Due to time constraints, the functionality of this module was simulated using a presentation created in Microsoft Powerpoint. The user interface, including buttons, menus, and content boxes, were designed in Adobe Illustrator. Pre- and post-operative states for each idealized patient were saved as jpegs from Adobe Photoshop and imported into Powerpoint. Each screen was designed to include hover and click states of buttons, and transitions between each screen. The flow of information through the module was simulated using animation. The informational text of the module was reviewed by Dr. Devin O'Brien-Coon and revised prior to its insertion into the Powerpoint presentation.



*Figure 17. Rendering technique in Adobe Photoshop used to create the FFS art assets*



*Figure 18. A revision of the artwork for the pre-operative White/Caucasian patient phenotype. Shadows of the face were reworked to more accurately portray underlying bone structure. The eyebrows were reshaped to give them a more typical masculine shape. The early version is on the left, and the updated version is on the right.*



*Figure 19. Final version of FFS art assets for the profile view of the Black/African American racial phenotype. The masculine profile is on the left, and the feminine profile is on the right.*

## Results and Discussion

### *Visual Problem Solving*

Several problems unique to the subject matter of this thesis required thoughtful decision-making to produce illustrations that provided maximum clarity and educational value for the target audience: patients considering gender-affirming surgery. This thesis produced the following assets: Nine full color images describing the transgender vaginoplasty procedure (Figures 20-24), six full color images describing the three stages of an RFFF phalloplasty (Figures 24-26), two single page donor site fact sheets (Figures 27 and 28), a forearm vs thigh donor site comparison illustration (Figure 29), a dermal regeneration template fact sheet, and ten, full color images describing FFS. The vaginoplasty and phalloplasty images were compiled into two illustration series designed for print and web viewing. The donor site fact sheets, donor site comparison illustration, and dermal regeneration template fact sheet were designed for print and web viewing. The FFS images were designed to be incorporated into an interactive web module.

### *Sequential Images and Small Multiples*

The vaginoplasty illustration series posed a challenge because the existing male anatomy of the patient is disassembled and repurposed in a sequence of complex transformations to create female genitalia. It is difficult to conceptualize which specific tissue is moved to new locations and to understand the effect on post-operative recovery and long-term upkeep of the neo-vagina. The patient would likely view the perineum area through a mirror in an informal lithotomy position in order to clean the surgical wound and to locate the opening of the neo-vagina to perform dilation. A sagittal view does not allow the viewer to see the neo-vagina from the patient's perspective. Conversely, a perineal view was inadequate to convey the location of the neo-vagina in relation to other deep structures. A sagittal view showing the neo-vagina located in a space bordered by the bladder and prostate anteriorly, the rectum posteriorly, and the rectovesical pouch superiorly, provides context for the potential development of a postoperative rectovaginal fistula, and illustrates limitations to the depth of the neo-vagina. Because it was necessary to portray both external anatomy and deep internal structures to provide a complete picture of the surgical changes, a perineal view and parasagittal view presented side-by-side was identified as the best way to convey the necessary information.

Due to the complex nature of the vaginoplasty procedure, it was determined that multiple steps

were required to summarize the procedure. A single illustration depicting one moment in time was insufficient to provide enough context to understand how the tissue of one area is moved and changed to form a new structure. It is difficult to make the conceptual jump from the external structure of a penis, to the internal cavity of a vagina without intermediate steps.

Small Multiples describes a visualization concept where multiple views, steps, or data sets use identical elements to emphasize changes made, so that these changes can be directly compared. This project used a variation of the Small Multiple Design Solution described by Edward Tufte (*Envisioning Information*, p. 79). When sequential steps were required to depict complex information, only the aspects of the image that were changing throughout the sequence were modified so viewers could easily distinguish them. These same design solutions were applied to the phalloplasty series.

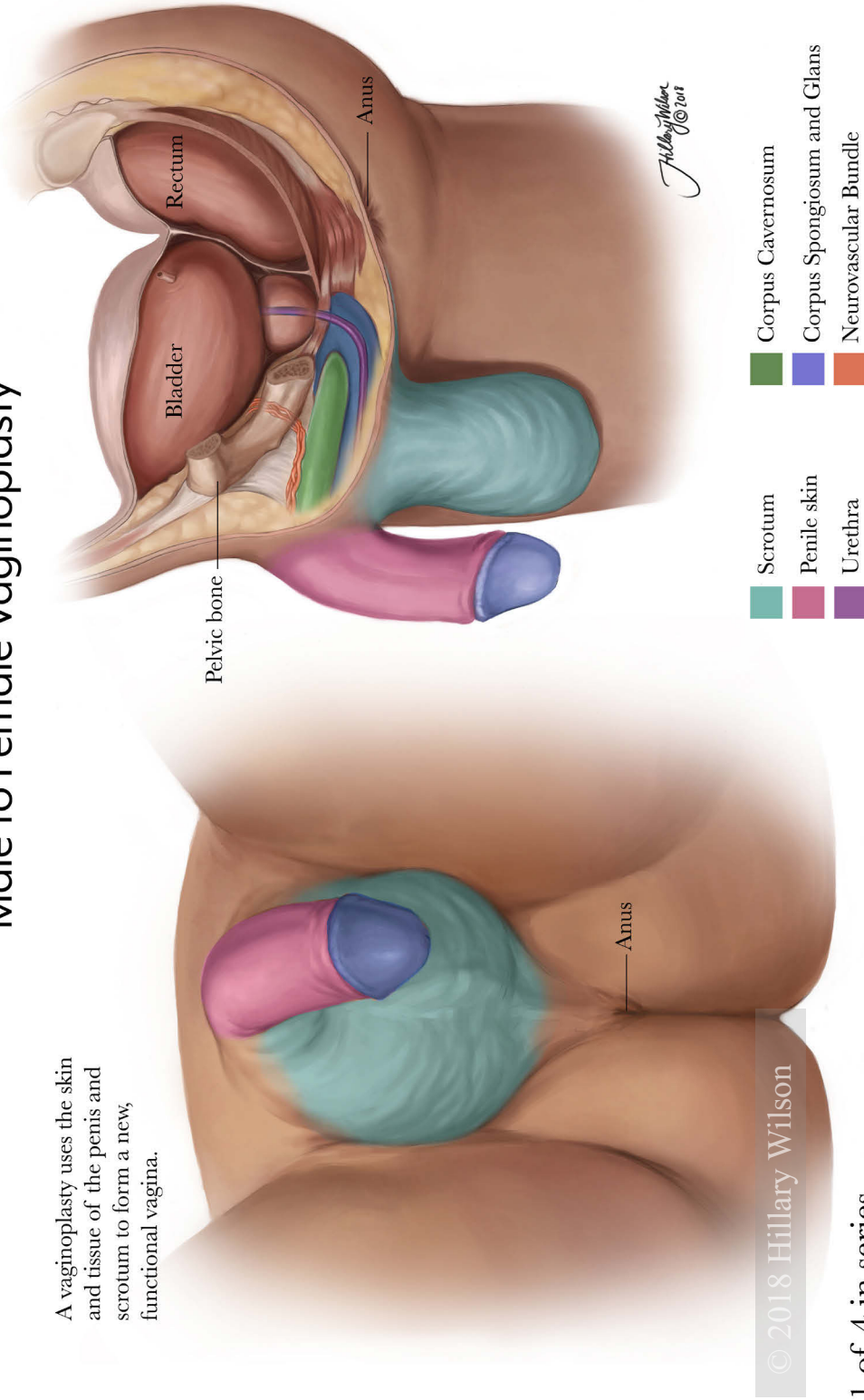
#### *Color Coding Design Solution to Track Tissue Repositioning*

Another challenge in creating these illustrations was determining how the viewer would distinguish skin/tissue taken from different areas. Some components of the anatomy are detached and moved as a free flap, and some remain attached but are stretched and/or repositioned and reshaped. For example, it is common for the neo-vagina to be formed from skin from both the penis and the scrotum, with the scrotal tissue detached and moved to the end of the penile skin tube. This technique is commonly used if the patient has been circumcised and there is no tissue from the prepuce to add to the depth of the skin tube. Removal of hair from the scrotum is required prior to surgery to prevent the growth of hair inside the neo-vagina. It is easier to emphasize the need for hair removal (electrolysis or laser removal) when the neo-vagina is depicted as formed from skin of two different locations: the penis, which does not contain very much hair, and the scrotum, which typically has substantial pubic hair. It was also important to convey that the tissue on the perineum is significantly stretched in a posterior direction during the creation of the neo-vagina. This stretching creates a pouching effect that helps create the labia majora, and also gives the vagina a more natural appearance. Typically, the cisgender female vagina is located more posterior than the position of a cisgender male scrotum. The system of color-coding was devised to help the viewer track the movement of each tissue type and distinguish between complex anatomy in the groin, before, during and after the procedure.

The vaginoplasty illustration series, which includes both perineal and parasagittal views as well as a system of color-coding, is novel because it provides solutions to the aforementioned visual problems, yet maintains the clarity and simplicity appropriate for patient education. This design solution can be applied to a variety of complex plastic surgery procedures in addition to gender-affirming surgery.

# Male to Female Vaginoplasty

A vaginoplasty uses the skin and tissue of the penis and scrotum to form a new, functional vagina.



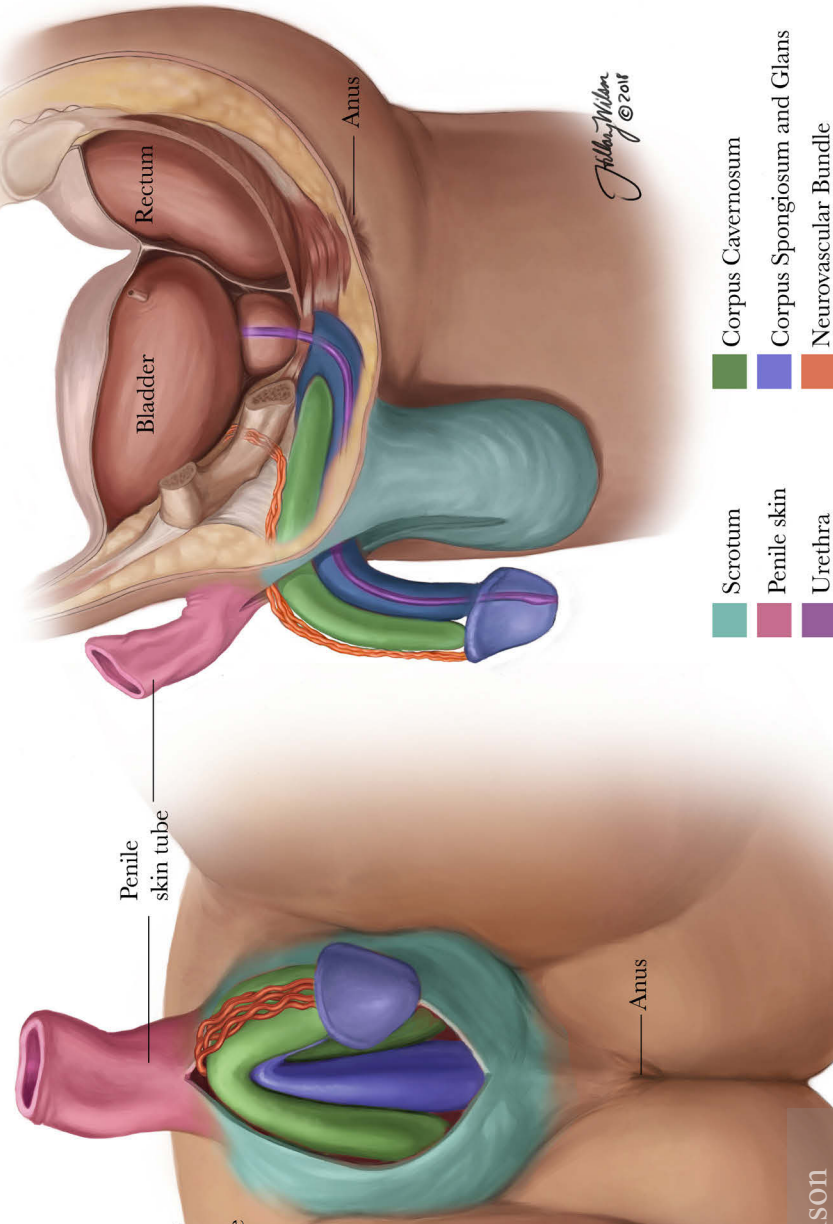
1 of 4 in series

Figure 20. Illustration 1 of 4 in the Vaginoplasty Series



## Male to Female Vaginoplasty

The tissue of the **penis** is separated from the structures underneath to form a skin tube. The **bundle of nerves and blood vessels** on the top of the penis remain attached to the glans tissue



© 2018 Hillary Wilson

2 of 4 in series

Figure 21. Illustration 2 of 4 in the Vaginoplasty Series



# Male to Female Vaginoplasty

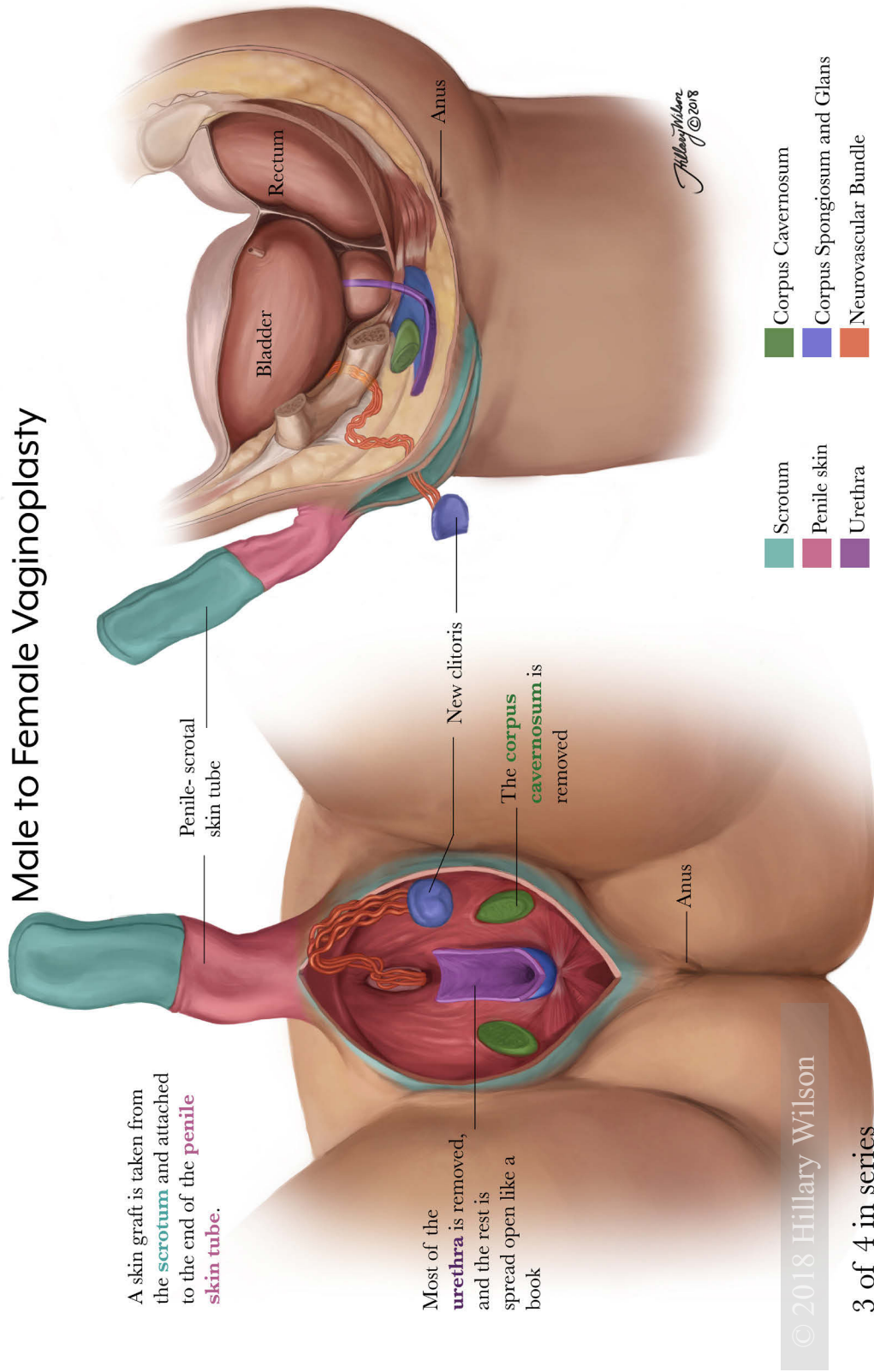
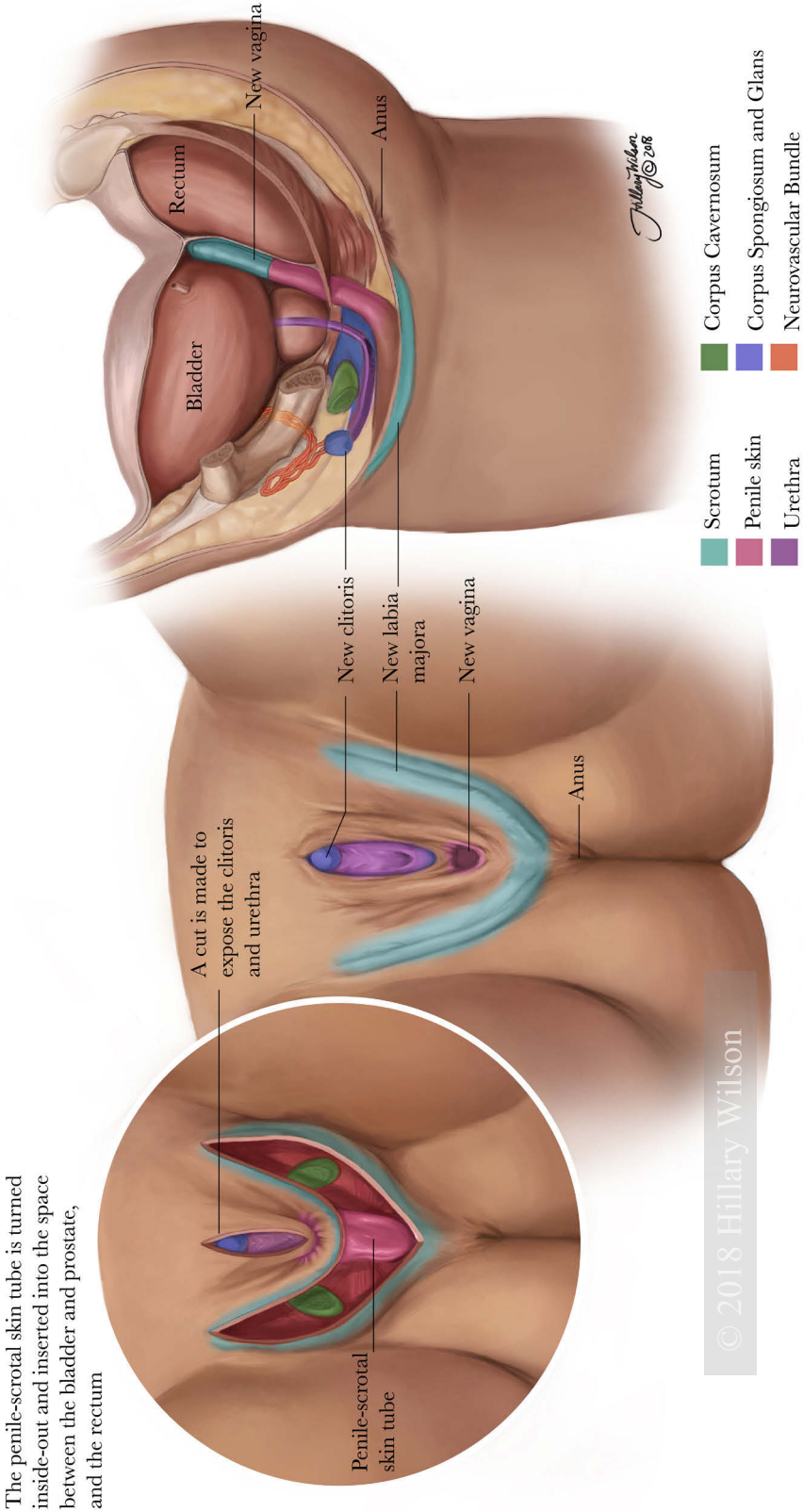


Figure 22. Illustration 3 of 4 in the Vaginoplasty Series.

# Male to Female Vaginoplasty



4 of 4 in series

Figure 23. Illustration 4 of 4 in the Vaginoplasty Series. An additional inset was added for clarity

### *Resources to Enhance Patient Doctor Communication and Decision Making*

Without visual aids, it is often difficult for surgeons who perform gender-affirming surgery to convey to patients why an option may not be viable or practical for the patient, or what the specifics of the surgical procedure may mean for the patient's post-operative recovery. This thesis produced imagery designed to facilitate surgeon and patient communication.

The donor site series, including a donor site comparison poster and two single-page fact sheets was designed to facilitate dialogue that frequently occurs between surgeon and patient. The single page fact sheets contain information about the benefits and drawbacks of each donor site, and what surgical outcomes would make one donor site a better choice (Figures 24-28). Similarly, the donor site comparison poster highlights information that would commonly arise in patient questions, such as why flaps cannot be thinned, what the difference is between a forearm flap and thigh flap phallus, and whether or not sexual intercourse will be possible post-operatively (Figure 29). The surgeon is able to use the poster and fact sheets in a clinic setting to supplement pre-operative verbal consultation.

The FFS interactive module was designed to provide clear visuals that demonstrate subtle changes made to faces of three different racial phenotypes during surgery (Figures 30-39). This resource allows the surgeon to more easily convey what is surgically possible, and the patient can make more informed decisions regarding elective surgery. The interactive component is also designed to allow the patient to deepen their understanding at their own pace without the surgeon present.

## Forearm Flap Phalloplasty Stage 1: Phallus creation

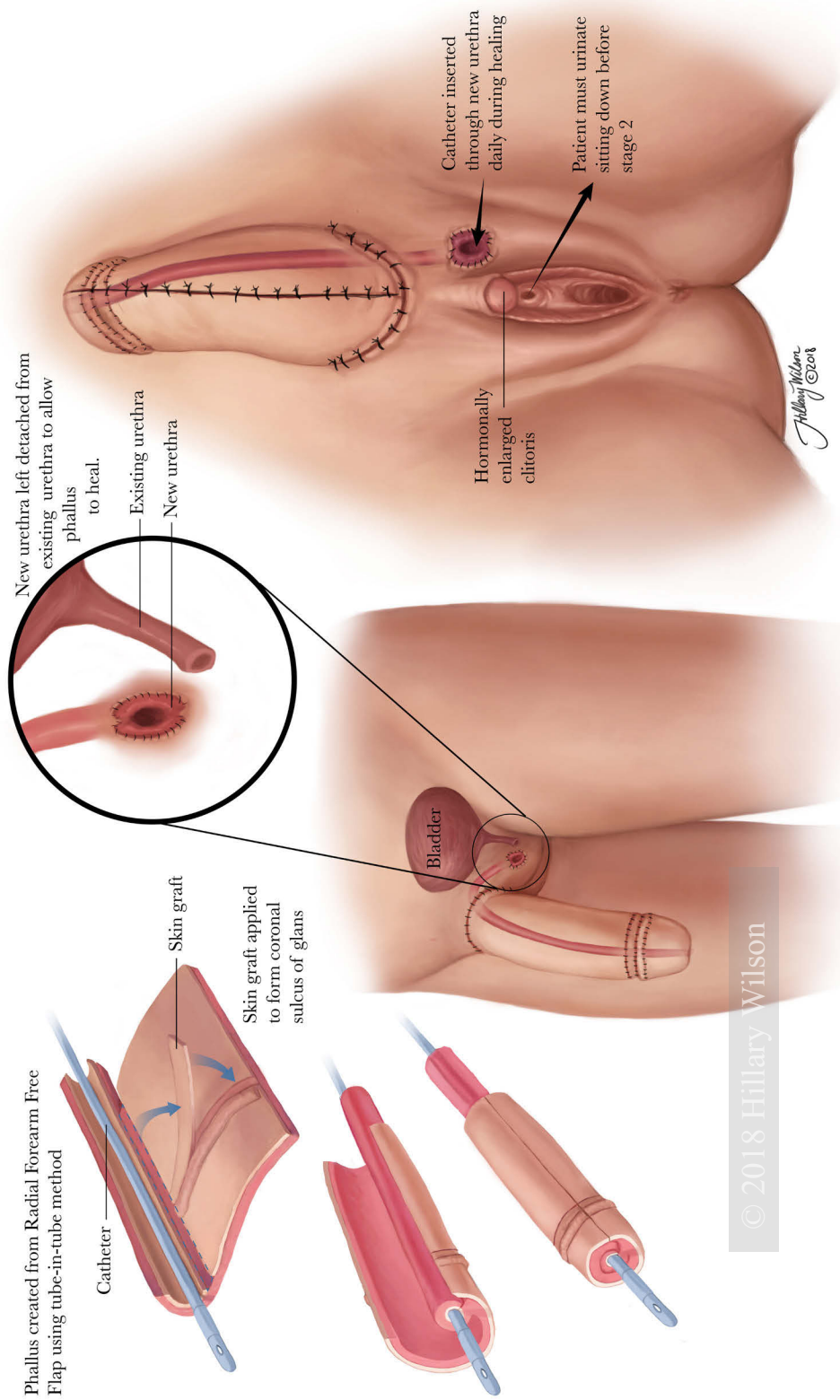


Figure 24. Stage one of FTM radial free forearm flap phalloplasty. Illustration depicts the creation of the phallus, the location of orifices after surgery, and actions the patient must take before stage 2

## Forearm Flap Phalloplasty Stage 2: Urethral lengthening and scrotoplasty

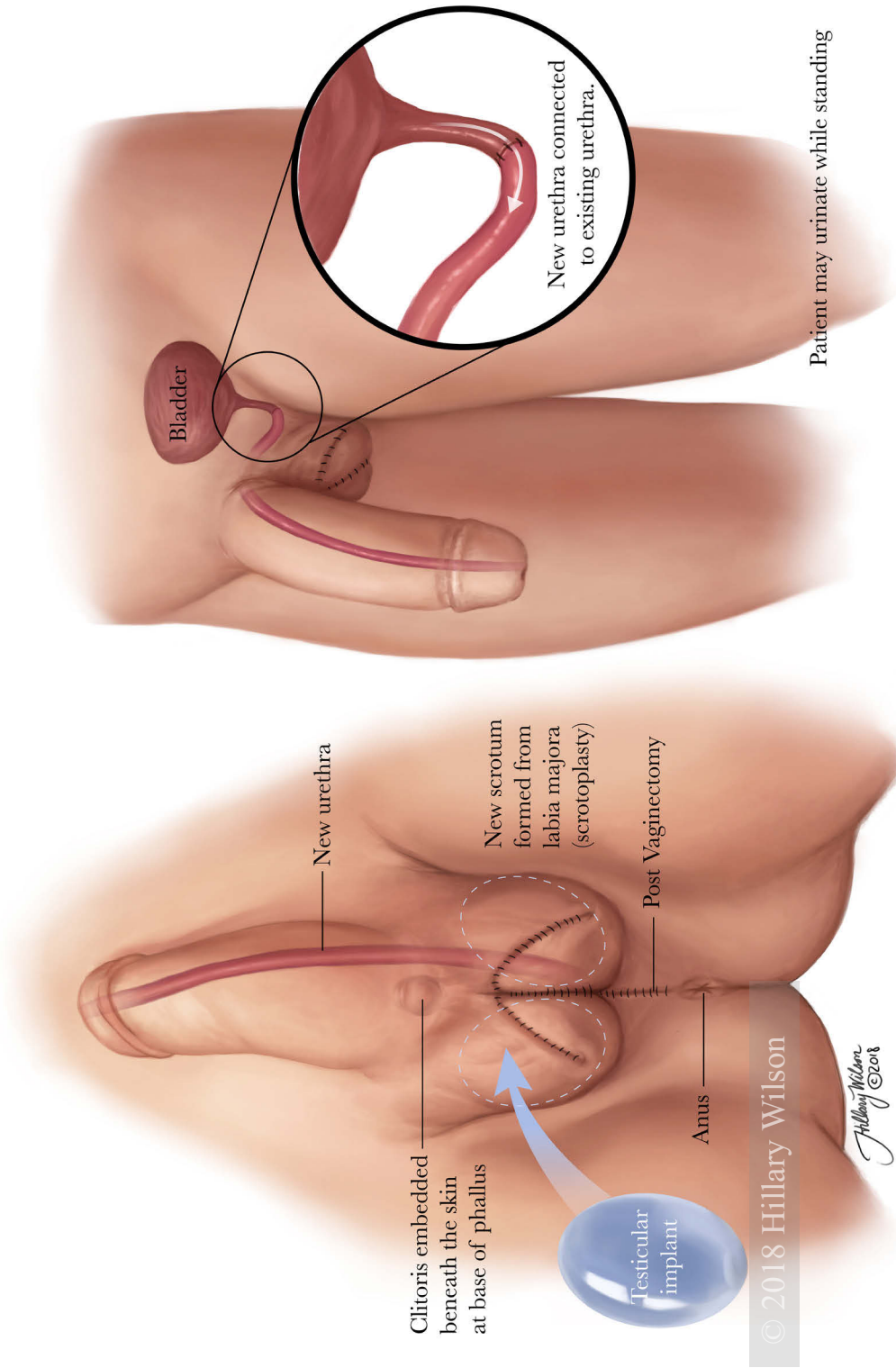


Figure 25. Stage two of a FTM radial free forearm flap phalloplasty. Illustration depicts the newly lengthened urethra, scrotoplasty, and insertion of testicular implants



## Forearm Flap Phalloplasty Stage 3: Penile Prosthesis

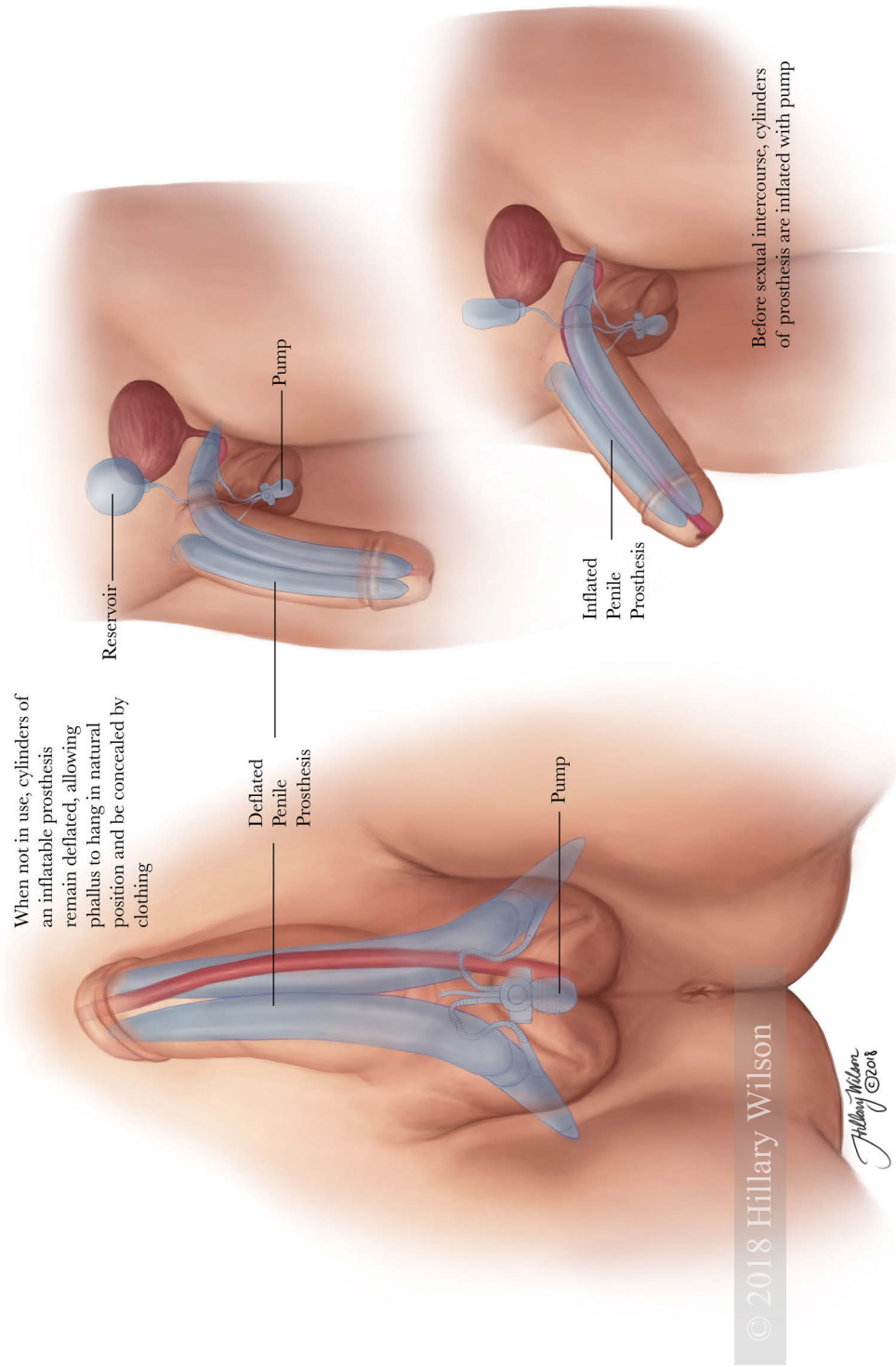


Figure 26. Stage three of a FTM radial free forearm flap phalloplasty. Illustration depicts the insertion of a penile prosthesis

# Radial Free Forearm Flap

## An Overview

### The Forearm as a Donor Site

Benefits	Drawbacks
<ul style="list-style-type: none"> <li>• Good sensation</li> <li>• Thin skin creates phallus that allows for insertion of stiffener</li> <li>• Very little hair</li> </ul>	<ul style="list-style-type: none"> <li>• Obvious scarring of donor site</li> <li>• Low use of arm during recovery</li> </ul>

Phallus  
Lateral antebrachial cutaneous n

Urethra  
Medial antebrachial cutaneous n

### Why the Forearm?

The forearm is usually the donor site of choice if the patient would like **urethral lengthening** and a **penile prosthesis**

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### What is Two Point Discrimination?

**Two point discrimination** is the ability to recognize two objects touching the skin as two distinct points, not one. It is often tested during neurological exams and is used to determine how much sensation an area has. Two point discrimination is very high in the forearm because the forearm is packed with sensory nerves.

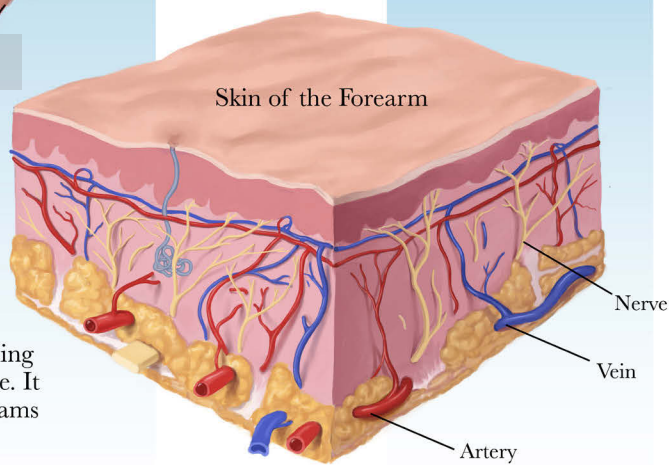
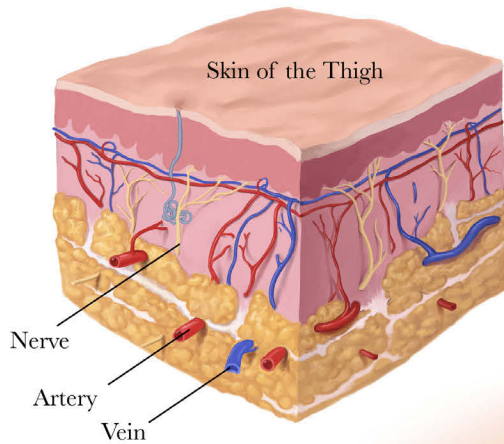


Figure 27. The donor site fact sheet explaining the radial free forearm flap donor site, including the tissue present and reasons for choosing the forearm as a donor site.

# Anterolateral Thigh Flap

## An Overview



## The Thigh as a Donor Site

### Benefits

- Donor site scar easy to conceal
- Healing period of donor site unlikely to affect daily activities

### Drawbacks

- Thick tissue at donor site
- Excess hair
- Sensation can be low

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### Why the Thigh?

The thigh is usually the donor site of choice if the patient does not want urethral lengthening or a penile prosthesis, and would like to have a less prominent scar

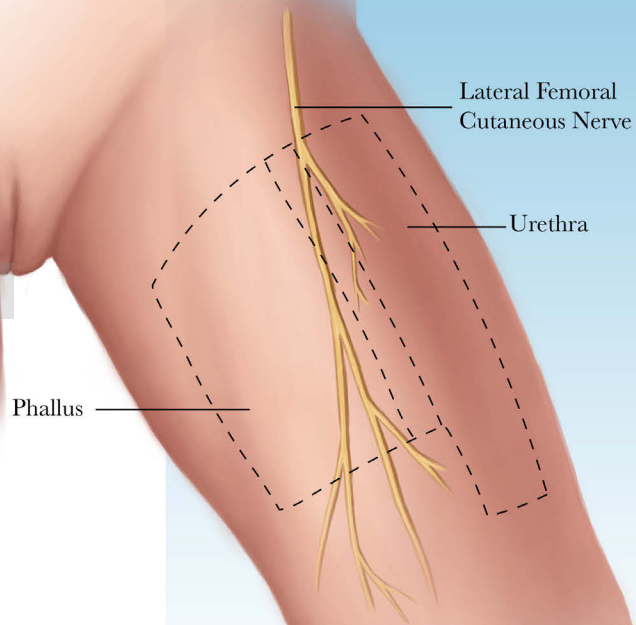


Figure 28. The donor site fact sheet explaining the anterolateral thigh donor site.



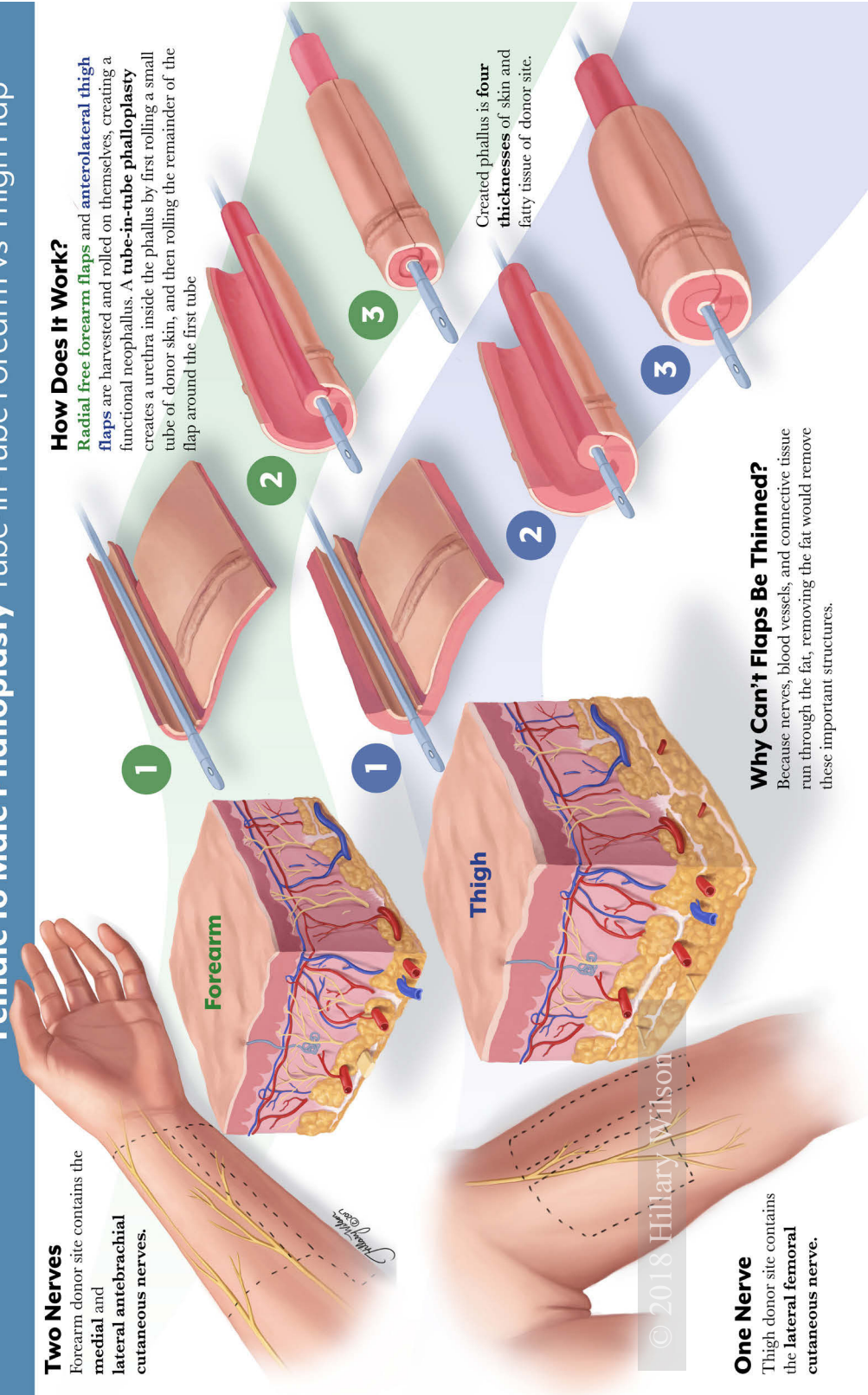
## Female to Male Phalloplasty Tube-in-Tube Forearm vs Thigh Flap

### Two Nerves

Forearm donor site contains the **medial and lateral antebrachial cutaneous nerves**.

### How Does It Work?

**Radial free forearm flaps** and **anterolateral thigh flaps** are harvested and rolled on themselves, creating a functional neophallus. A **tube-in-tube phalloplasty** creates a urethra inside the phallus by first rolling a small tube of donor skin, and then rolling the remainder of the flap around the first tube



### One Nerve

Thigh donor site contains the **lateral femoral cutaneous nerve**.

### Why Can't Flaps Be Thinned?

Because nerves, blood vessels, and connective tissue run through the fat, removing the fat would remove these important structures.

Figure 29. The Donor Site Comparison illustration comparing the differences between the RFFF and ALT donor sites

## Facial Feminization Surgery (FFS) Patient Guide

Toggle between front and profile views, then click on an area of the face to learn more about the related procedure



Figure 30. Designed functionality of the FFS interactive module: Patient 1 (Black/African American) has been selected in a front view.

# Facial Feminization Surgery (FFS) Patient Guide

FFS Info

Select Patient

123

Select View

FrontProfile

Select Feature

Forehead

Nose

Jawline

Adam's Apple

Brow

Lips

Toggle between front and profile views, then click on an area of the face to learn more about the related procedure

[Close]

What is FFS?

**Facial Feminization Surgery (FFS)** surgically alters masculine bone structure that cannot be changed by hormones. These surgeries are usually **reductive**, meaning they reduce the size of existing features. Often, areas of the face such as the forehead, nose, jawline and chin, Adam's apple, brow, and lips can be subtly changed by a surgeon to give the patient a more feminine appearance. Typically, in masculine faces these features are more angular, are larger, or contain more bony areas that stick out. Though each surgery is different for everyone, commonalities can help the patient know what to expect and what is possible.

The main limitation of FFS is that it cannot decrease the size of the entire face, only certain features. Thus, these features must not be changed so much that while they may look good in isolation, they become out of harmony with the parts of the face that are unchanged.

This module depicts patients that have undergone procedures on multiple facial features. In some case, a patient may not need multiple facial features changed to get satisfying results.

Pre-Op

Post-Op

Figure 31. Designed Functionality of the FFS interactive module: Patient 1 (Black/African American) has been selected in a front view. The button for more information on FFS has also been selected, prompting an information box to appear:

Facial Feminization Surgery  
(FFS) Patient Guide

FFS Info

Select Patient

123

Select View

FrontProfile

Select Feature

Forehead

Nose

Jawline

Adam's Apple

Brow

Lips

[close]

NOSE

Rhinoplasty

A rhinoplasty is plastic surgery performed on the nose. In FFS, a rhinoplasty is used to make the nose appear more feminine. A masculine nose is often slightly larger, has a more bulbous tip, goes farther out from the face, and points out straight rather than tilting up.

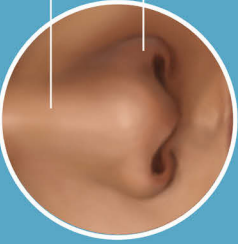
What can FFS do?  
During an FFS rhinoplasty, the surgeon may make the tip of the nose have more of a point, turn the tip up slightly, or subtly define the bridge of the nose.

What can FFS not do?  
FFS can't change things like how high up on the face the nose sits or drastically change the size of the ala of the nose.

In Black/African American patients, extra care is taken by the surgeon to not make the nose more narrow or the bridge more defined than is typical.

Click the picture to toggle between masculine and feminine

Feminine



Pre Op

Post Op

[Speaker Icon]

Figure 32. Designed Functionality of the FFS interactive module: Patient 1 (Black/African American) has been selected in a front view. The button for the nose facial feature has also been selected, prompting an information box to appear. The information box includes a toggle of the pre- and post-operative nose.

47



## Facial Feminization Surgery (FFS) Patient Guide

Toggle between front and profile views, then click on an area of the face to learn more about the related procedure

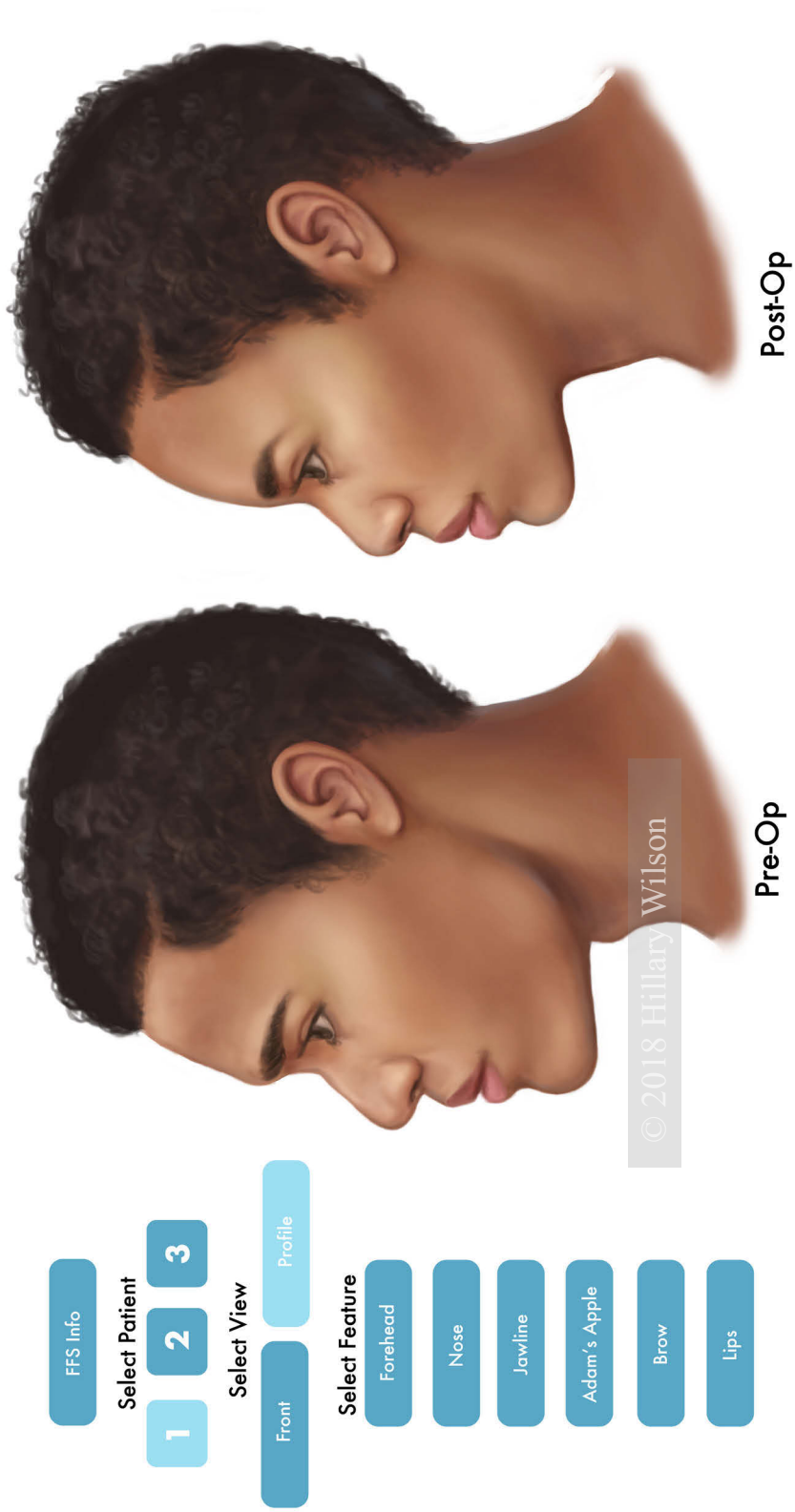


Figure 33. Designed Functionality of the FFS interactive module: Patient 1 (Black/African American) has been selected in a profile view.

## Facial Feminization Surgery (FFS) Patient Guide

FFS Info

1

2

3

Select Patient

Select View

Front

Profile

Select Feature

Forehead

Nose

Jawline

Adam's Apple

Brow

Lips

Teach

Learn

Practice

Review

Share

NOSE

Rhinoplasty

A rhinoplasty is plastic surgery performed on the nose. In FFS, a rhinoplasty is used to make the nose appear more feminine. A masculine nose is often slightly larger, has a more bulbous tip, goes farther out from the face, and points out straight rather than tilting up.

What can FFS do?

During an FFS rhinoplasty, the surgeon may make the tip of the nose have more of a point, turn the tip up slightly, or subtly define the bridge of the nose.

What can FFS not do?

FFS can't change things like how high up on the face the nose sits or drastically change the size of the ala of the nose.

In Black/African American patients, extra care is taken by the surgeon to not make the nose more narrow or the bridge more defined than is typical.

Bridge

Ala

Feminine

Click the picture to toggle between masculine and feminine

Pre Op

Post Op

Figure 34. Designed Functionality of the FFS interactive module: Patient 1 (Black/African American) has been selected in a profile view. The button for the nose facial feature has also been selected, prompting an information box to appear. The information box contains a toggle showing the pre- and post-operative nose in profile view.

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# Facial Feminization Surgery (FFS) Patient Guide

FFS Info

Select Patient

1

2

3

Select View

Front

Profile

Select Feature

Forehead

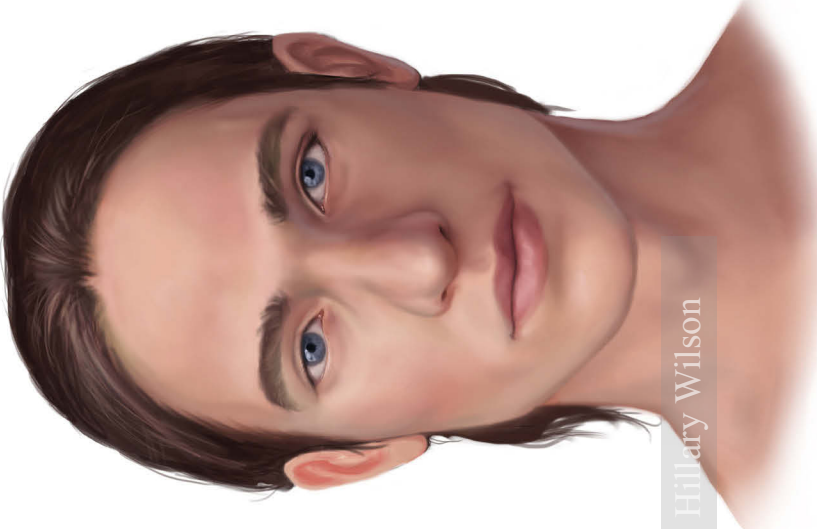
Nose

Jawline

Adam's Apple

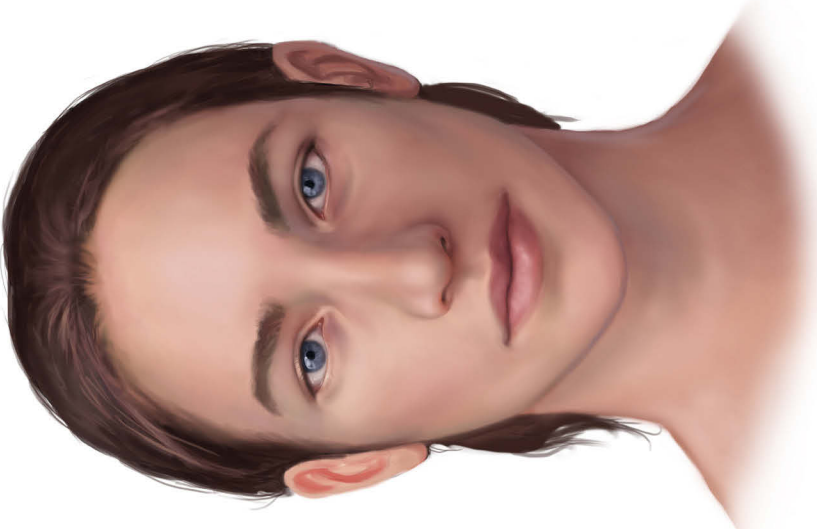
Brow

Lips



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**Pre-Op**



**Post-Op**

Toggle between front and profile views, then click on an area of the face to learn more about the related procedure

Figure 35. Designed Functionality of the FFS interactive module: Patient 2 (White/Caucasian) has been selected in a front view.

# Facial Feminization Surgery (FFS) Patient Guide

FFS Info

Select Patient

1

2

3

Select View

Front

Profile

Select Feature

Forehead

Nose

Jawline

Adam's Apple

Brow

Lips

[Close]

NOSE

Rhinoplasty

A rhinoplasty is plastic surgery performed on the nose. In FFS, a rhinoplasty is used to make the nose appear more feminine. A masculine nose is often slightly larger, has a more bulbous tip, goes farther out from the face, and points out straight rather than tilting up.

What can FFS do?

During an FFS rhinoplasty, the surgeon may make the tip of the nose have more of a point, turn the tip up slightly, or subtly define the bridge of the nose.

What can FFS not do?

FFS can't change things like how high up on the face the nose sits or drastically change the size of the ala of the nose.

In White/Caucasian patients, the surgeon will take extra care to ensure the nose does not become too small, and the tip is not tilted too far upwards.

Click the picture to toggle between masculine and feminine

Masculine

Bridge

Ala

🔊

Figure 36. Designed Functionality of the FFS interactive module: Patient 2 (White/Caucasian) has been selected in a front view. The button for the nose facial feature has also been selected, prompting an information box to appear. The information box contains a toggle of the pre- and post-operative nose in a front view.

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## Facial Feminization Surgery (FFS) Patient Guide

Toggle between front and profile views, then click on an area of the face to learn more about the related procedure

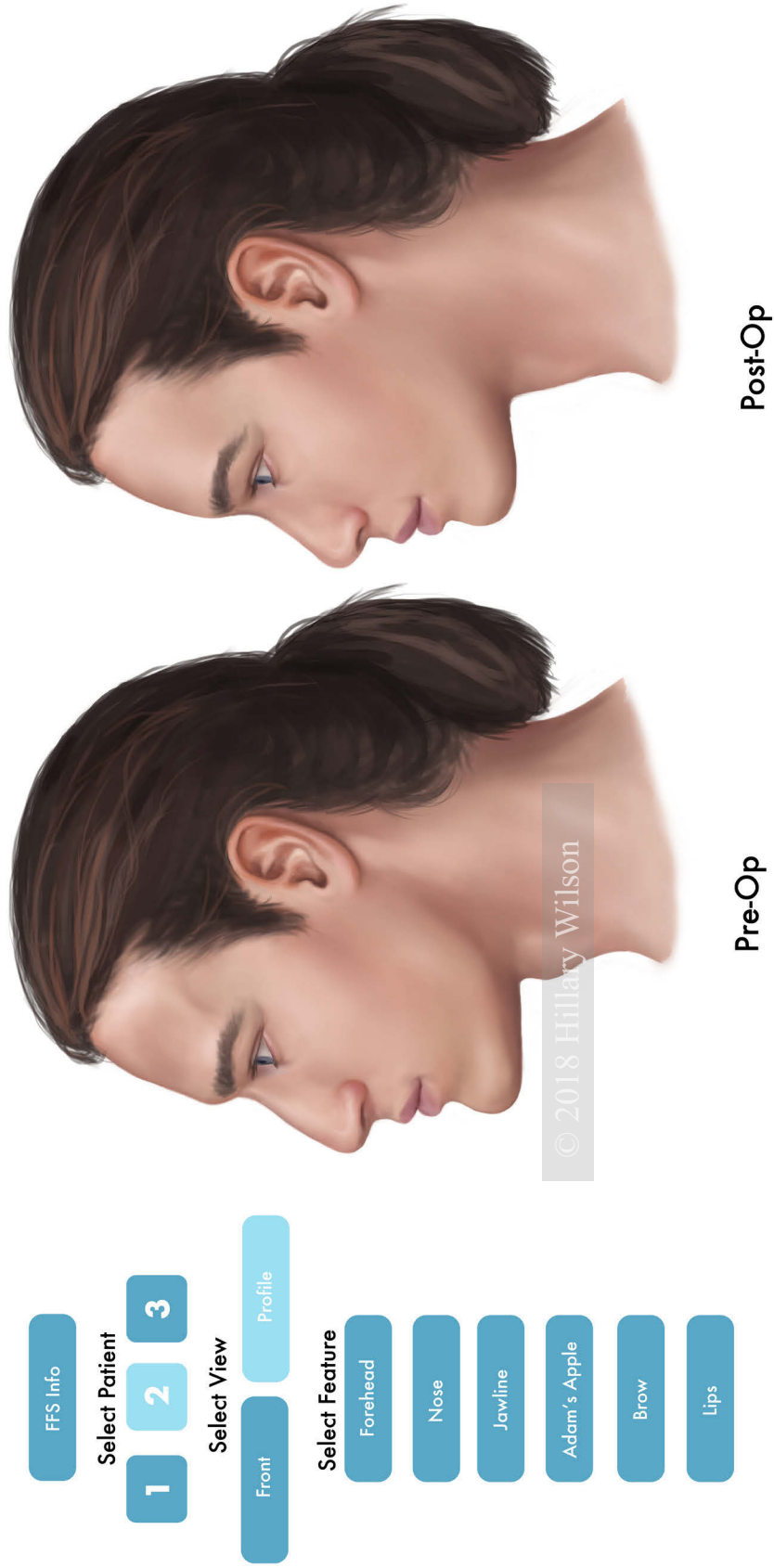
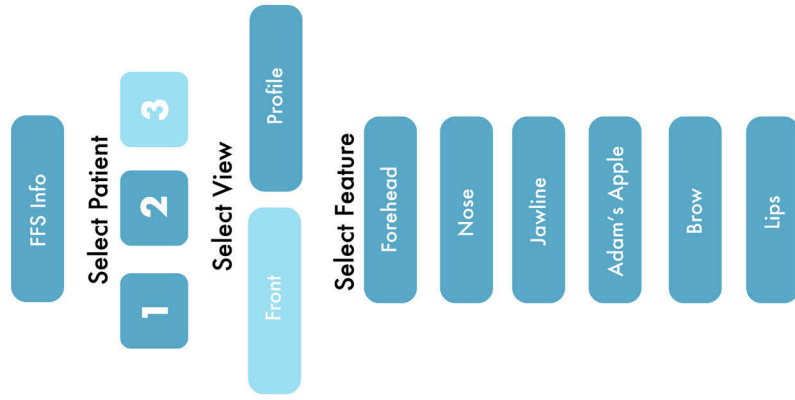


Figure 37. Designed Functionality of the FFS interactive module: Patient 2 (White/Caucasian) has been selected in a profile view.

## Facial Feminization Surgery (FFS) Patient Guide



Toggle between front and profile views, then click on an area of the face to learn more about the related procedure



Figure 38. Designed Functionality of the FFS interactive module: Patient 3 (Asian) has been selected in a front view.

Facial Feminization Surgery (FFS) Patient Guide

FFS Info

Select Patient

123

Select View

FrontProfile

Select Feature

Forehead

Nose

Jawline

Adam's Apple

Brow

Lips

NOSE

Rhinoplasty

A rhinoplasty is plastic surgery performed on the nose. In FFS, a rhinoplasty is used to make the nose appear more feminine. A masculine nose is often slightly larger, has a more bulbous tip, goes further out from the face, and points out straight, rather than tilting up.

What can FFS do?

During an FFS rhinoplasty, the surgeon may make the tip of the nose smaller, turn the tip up slightly, or subtly define the bridge of the nose. The bridge of the nose may be rasped to make it less prominent and fractured to make it more narrow.

What can FFS not do?

FFS can't change things like how high up on the face the nose sits or drastically change the size of the ala of the nose.

In Asian patients, extra care is taken by the surgeon to not make the nose too small or narrow, or give it more of a defined bridge than is typical.

Click the picture to toggle between masculine and feminine

Feminine

Bridge

Ala

[Close]

Figure 39. Designed Functionality of the FFS interactive module: Patient 3 (Asian) has been selected in a front view. The button for the nose facial feature has also been selected, prompting an information box to appear. The information box contains a toggle of the pre- and post-operative nose from a front view.

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### *Feedback from Stakeholders*

Because the purpose of this thesis was to produce a clear patient education resource, patients in the clinic of the JHCTH were shown drafts of the images and invited to provide general feedback on what they found clear, what was difficult to understand, and their reaction to the presentation of the material. The pool included pre- and post-operative vaginoplasty and phalloplasty patients and clinic coordinators. Feedback obtained during these meetings helped inform revisions to the final images to make them more accessible to a patient audience. In general, the patient audience preferred a high level of detail in the images, allowing them to learn more if they were interested. Labels were considered helpful in guiding the eye to and identifying important information. The patients reported that the color-coding of the vaginoplasty series was helpful in showing where tissue was moved. In reviewing the phalloplasty series, patients commented on the importance of ample visual information portraying how the post-operative area would look, including orifices and sutures. Images that conveyed in detail what actions the patient would have to take at the end of each stage of surgery to care for their postoperative anatomy (dilation, cleansing) elicited positive response. For example, a patient found it helpful that the stage 1 illustration mentioned the need for the patient to urinate while seated. When shown the forearm and thigh donor site comparison illustration, the visual portrayal of the different thicknesses of tissue with accompanying word story was noted to be clear and useful.

The images were reviewed by professionals at the JHCTH; these viewers held more knowledge of the procedures and terminology than the average clinic patient, but had less detailed understanding of the anatomy than content expert Dr. O'Brien-Coon. Feedback from these stakeholders led to several revisions to improve clarity. For example, it was determined that simple written descriptions would be added to the vaginoplasty series, in addition to the color-coding key. This additional word story would provide written cues to direct the viewer's attention and explain what was occurring in each step.

These stakeholders also described a need for imagery depicting the use of dermal regeneration templates (DRT) in surgical wound healing to address frequently asked questions. The Dermal Regeneration Template Fact Sheet was created to accompany the other illustrations of the Donor Site Series, and can be used in a clinic setting to explain the benefits of using DRTs to improve the appearance of donor site scars (Figure 40).

Dr. O'Brien-Coon provided early insight into the most challenging concepts to convey to patients.

When he reviewed early drafts of the images, he was able to identify which aspects of the illustrations would provide clarity and emphasis to these difficult to convey concepts. Throughout, he provided anatomical review for feasible surgical outcomes.

### *Novel Contributions to Transgender Patient Resources*

Gender-affirming surgery is being developed and performed with a greater frequency than in any previous period in history. For patients considering gender-affirming surgery, the most common resources found online are pre- and post-surgical photographs posted by patients. These images may be useful for seeing actual patient outcomes, but do not deepen the understanding of the procedure, aid in decision making, or provide concrete reasons for why adverse outcomes to a particular procedure may be expected in some situations. These photographs and online surgical videos may assuage curiosity regarding what happens in the procedure, but they do not educate in a practical manner. For example, in a video of a vaginoplasty or phalloplasty procedure, the surgical field is small to ensure a sterile environment for the patient during surgery, but this limits context for the outside viewer. The field is also bloody and filled with amorphous fatty tissue making it near impossible for one without a medical background to distinguish anatomical structures. These videos can be jarring and gruesome for viewers who are not comfortable with blood or not used to viewing surgical procedures.

This thesis produced a series of educational illustrations designed to teach patients about the risks, potential complications, and typical outcomes of gender-affirming surgery, and to provide information to aid patients in their decision making during the transitioning process. This well-illustrated, accurate resource allows patients to communicate more clearly with surgeons and to make more informed decisions regarding procedures in which they are highly invested. The artwork produced is designed to educate family, friends, and healthcare providers who are not familiar with gender-affirming surgery. A review of existing resources and literature revealed a lack of visual resources with accurate illustrations of an appropriate level of detail to teach transgender patients about gender-affirming surgery. In many cases, existing resources contain written information about specific procedures that can be performed during top and bottom surgery, but these resources often lack accompanying visuals designed to explain the procedures to a patient audience. In some cases, illustrations included to supplement the text are only marginally related to the subject matter, and could be more confusing to the viewer than helpful.

## Dermal Regeneration Templates Improving Scar Appearance

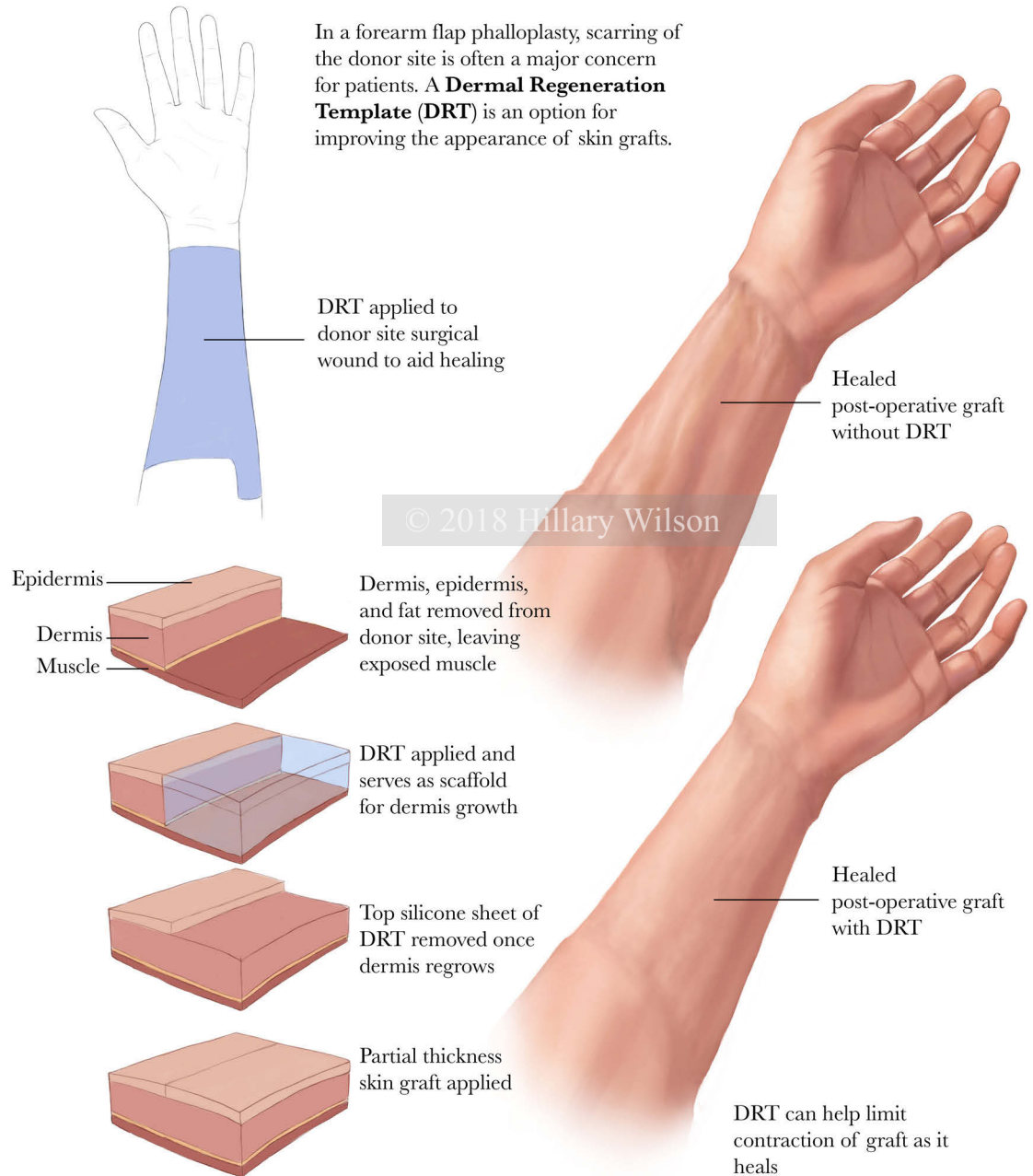


Figure 40. The Dermal Regeneration Template (DRT) fact sheet depicting simplified steps of the DRT's application and use. The illustration shows the benefit of using DRTs in the context of donor site wound healing.



There are no existing visual aids or illustrations on FFS that provide interactive pre- and post-operative features in the same manner as those produced in this thesis. Similar to resources for bottom surgery, existing supplementary visuals on FFS are often limited to pre- and post-operative photographs of patients, and in many cases, before and after photographs contain inconsistencies (angle, lighting, facial expression, makeup and hairstyles, etc.) that make it difficult to pinpoint the exact changes between before and after stages. Additionally, none of the existing resources found for FFS included an interactive component that allowed for additional exploration of the subject matter. The interactive FFS module designed in this thesis provides a novel educational tool because it allows the viewer to compare pre- and post-operative states in a consistent manner, view the same surgical changes in different racial phenotypes from a front and profile view, and learn about the procedures and terminology described within the helpful context of a visual guide.

#### *Asset Referral Information*

The illustrations created in this thesis will be located at:

[www.genderaffirmingsurgery.hwilsonillustration.com](http://www.genderaffirmingsurgery.hwilsonillustration.com).

Some of the illustrations will also be housed at [www.hwilsonillustration.com](http://www.hwilsonillustration.com). Access to these illustrations can be granted by contacting Hillary Wilson at [hillwilz77@gmail.com](mailto:hillwilz77@gmail.com), or through the website of the Department of Art as Applied to Medicine at the Johns Hopkins University School of Medicine. <http://medicalart.johnshopkins.edu/>. The Johns Hopkins Center for Transgender Health will retain print copies of the illustrations.

#### *Future Directions*

This thesis lays a framework for future expansion of patient education for transgender health to ensure continued improvement of patient outcomes and health equity. The coding and implementation of the FFS interactive module designed in this thesis is a natural next step. Additionally, resources depicting post-operative complications, such as rectovaginal fistulas, infection, urinary strictures and fistulas, and donor site morbidity, and their treatment is a necessary continuation of this thesis' scope. An expansion on post-operative care and maintenance procedures, including visuals to accompany vaginal dilation and cleaning instructions, as well as neo-urethral catheter dilation, would benefit this patient population. These would contribute to the holistic education and care of a transitioning individual. The illustrations created in this thesis will be displayed for public viewing on a website created using Wordpress. The website will

be a comprehensive resource describing gender-affirming surgery and options available for transgender patients. The images in this thesis will accompany informational text.

### *Conclusion*

There are now more patients seeking and more surgeons performing gender-affirming surgery than ever before. As surgical procedures are improved and patient outcomes become more favorable, it is important to continue improving the education of patient and downstream healthcare provider populations. The procedures patients undergo during gender-affirming surgery are complicated, lengthy, and require extreme commitment and investment, both psychological and financial, to increase chances of success. Currently, there is still disparity in treatment options and educational resources available for transgender individuals. Among the available educational resources, there are even fewer clear, visual resources that accurately portray the subject matter, or are specifically designed to be accessible to a patient or lay audience. Strengthening education can enhance transgender patients' ability to make informed decisions throughout their transitioning period, allowing them to have better, more productive dialogue with their surgeon, and leading to closer adherence to post-operative care instructions and long-term upkeep and maintenance. Moreover, it can improve the capacity of future health care providers to ensure they offer the same standard of care to this patient population as they would to other, less marginalized patient populations.

The illustrations produced in this thesis will help fill in gaps in knowledge of gender-affirming surgery in transgender patients, healthcare providers, and the general public. The illustrations will be available online and therefore easily accessible, ensuring that they have the ability to impact any individuals seeking to deepen their knowledge on the subject matter. The illustrations will also be used in the JHCTH as educational tools to improve communication between surgeon and patient, and ultimately improve healthcare for the transgender community.



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## Vita

Hillary Denyce Wilson was born in Wilmington, Delaware. She spent the majority of her childhood in North Carolina and attended High Point University for her undergraduate education. During that time, Hillary developed a thorough knowledge and appreciation for the life sciences while also nurturing a love for art. She graduated *magna cum laude* with a Bachelor of Science in Biology.

In 2016, Hillary continued her studies in the graduate program in Medical and Biological Illustration in the Department of Art as Applied to Medicine at the Johns Hopkins University School of Medicine. While at Hopkins, Hillary received an Award of Merit for her biological illustration Bower Construction of the Fawn-Breasted Bowerbird at the 2017 Association of Medical Illustrators conference in Austin, Texas. She also received a scholarship from the Vesalius Trust for her master's thesis in 2018. Hillary will receive her Master of Arts in Medical and Biological Illustration in May of 2018.